THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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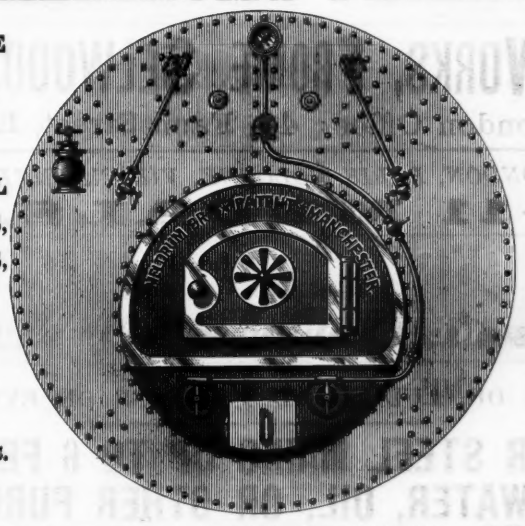

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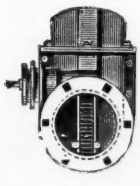

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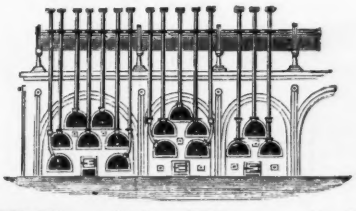

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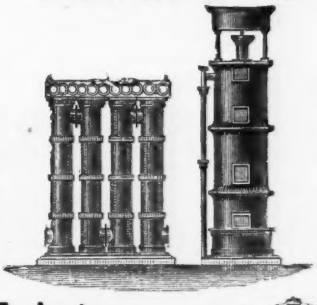

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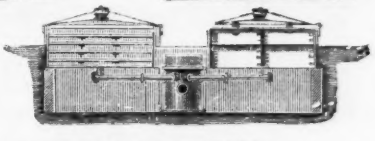

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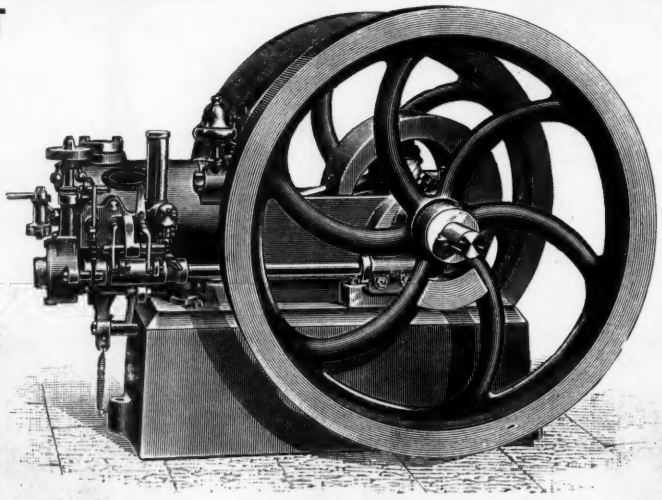

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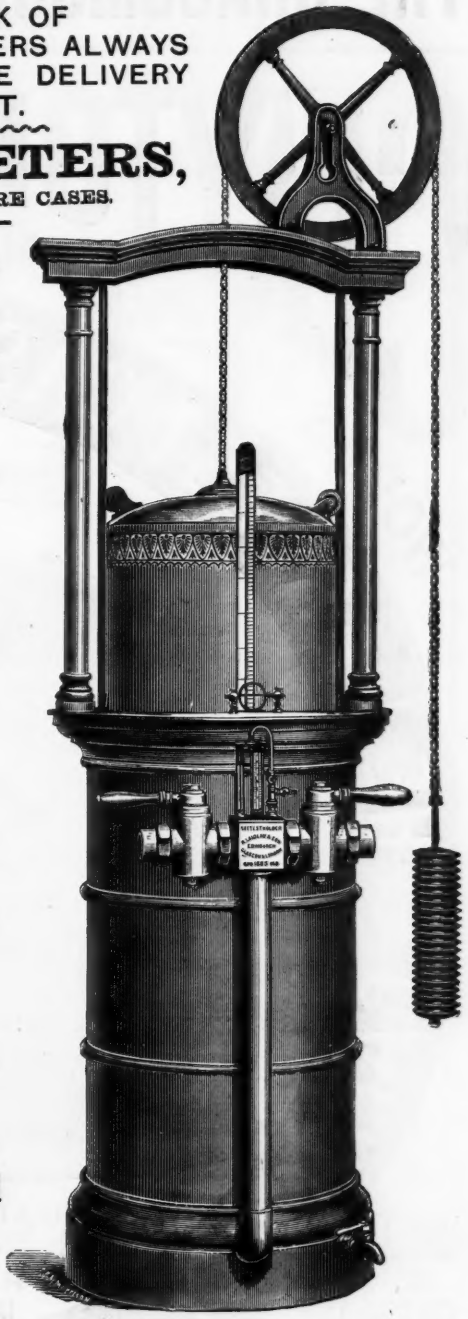

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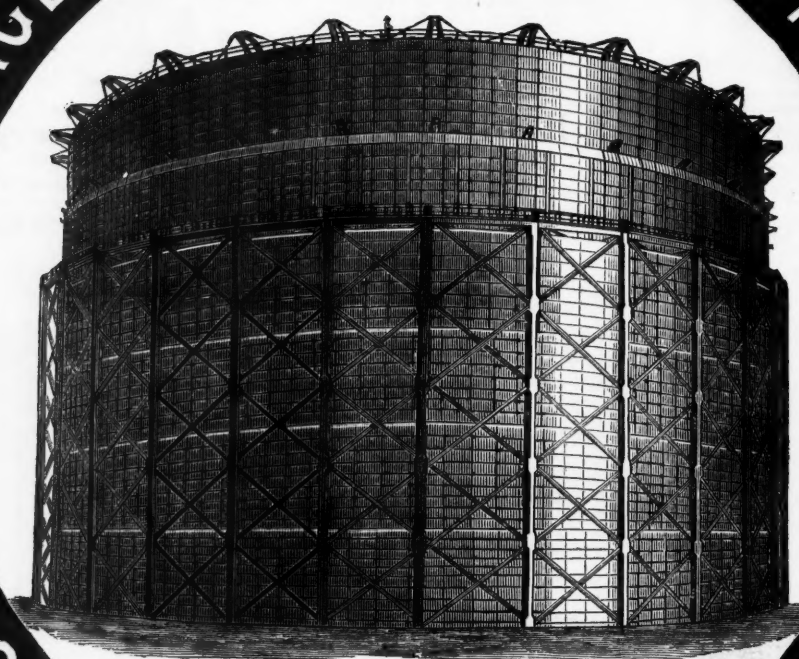

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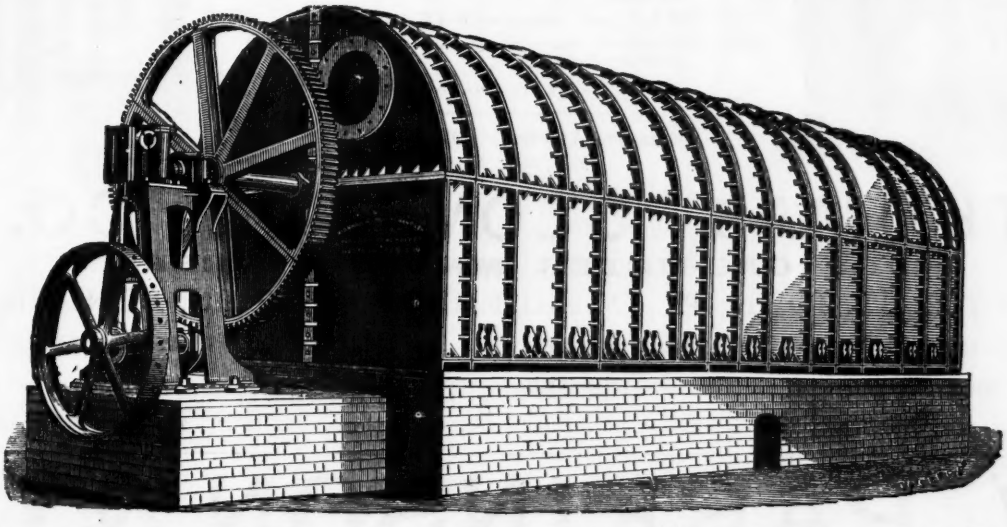

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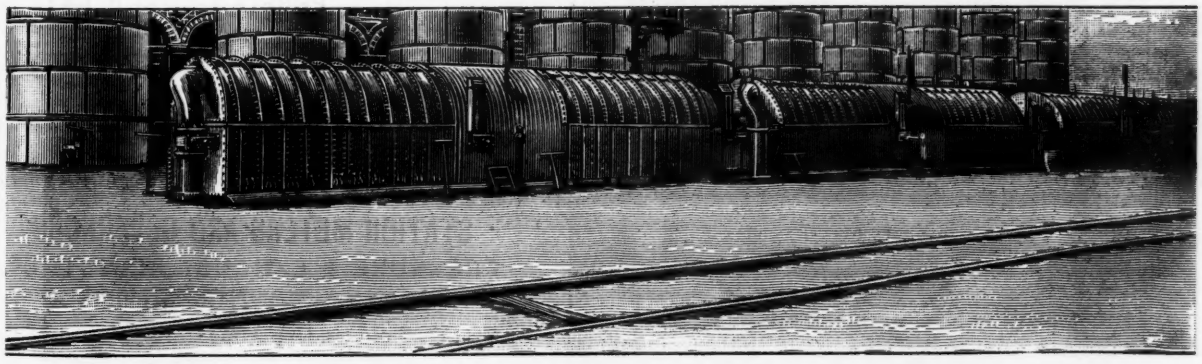

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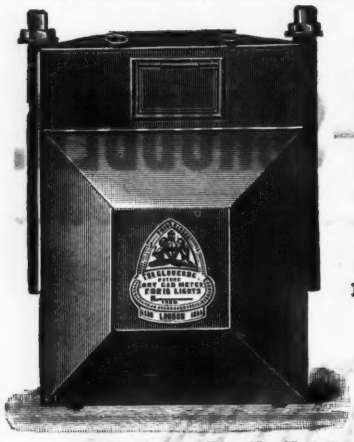

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 18, 1893.

The North British Association Meeting.

THE annual general meeting of the North British Association of Gas Managers will be held in the University College Buildings, Dundee, on Thursday, the 27th inst., under the presidency of Mr. T. Douglas Hall, of Montrose. As usual, the first or business day of the meeting will be devoted to getting through a long programme of papers, with discussions and motions, including the presidential address, with a visit to the Corporation gas-works during the midday adjournment, and a dinner in the evening. Certainly, it must be put to the credit of the North British gas managers that they "work when they work, and play "when they play;" for the second day of the meeting is to be appropriated for an excursion to the water-works at Monikie, the property of the Dundee Water Commissioners, which, as our Scotch Correspondent remarked last week, is a favourite holiday resort of the townspeople. Mr. Hall may be expected to give his audience a really interesting and instructive address; and the list of papers promises well. Scotch gas engineering has been lately enriched by the addition of a system of making gas from oil in which every gas manager north of the Tweed naturally takes a sort of paternal interest; and this system is to be theoretically and practically expounded to the meeting by Mr. W. Young and Mr. Alexander Bell, jun., of Peebles, whose two papers should be a valuable addition to the accumulating literature of the subject. The discussion of these communications will be rendered more complete by the inclusion of the deferred debate upon Mr. John Mackay's paper, on the enrichment of coal gas, read at last year's meeting. Four other papers swell the list and vary the category of technical subjects to be brought before the meeting. These consist of a paper by Mr. D. M. Nelson, of Glasgow, on "The Yeadon Process of "Gas Manufacture;" a communication from Mr. George Keillor, of Nairn, entitled "Notes on Prepayment Meters;" a paper on "Cooking by Gas," submitted by Mr. John Ballantyne, of Rothesay; and another on "Automatic "Appliances for Small Works," by Mr. Gilbert Little, of London and Aberdeen, the well-known head of the New Conveyor Company. We have great pleasure in complimenting the Committee of the Association and the Secretary (Mr. R. S. Carlow, of Arbroath) on this most creditable list of papers—the most satisfactory in appearance, indeed, that has come under our notice for a considerable period in connection with a gas managers' meeting. We hope the proceedings at Dundee will testify to the appreciation of the members generally of the efforts of the Committee to make the meeting worthy of the Association.

Sir J. Evans and Mr. A. W. Brown on Gas for Lighting and Power.

THE Society of Chemical Industry last week held their annual general meeting in Liverpool, under the presidency of Sir John Evans. The report of the Council shows the Society to be in a flourishing condition; and the meeting itself was a success. The Inaugural Address dilated, as was natural and proper, upon the importance of chemistry in connection with the manufacturing industries of the country. It contained some passing references to the gas industry, which were not conceived in the best spirit, or expressed in the happiest way. Indeed, the President appears, from the condensed report of his observations that has come to hand, to have talked of the coal-gas industry rather with the superficiality and disregard of data that one is accustomed to see in newspaper articles, than with the close grip of the subject to be expected of the head of a scientific society. He said: "Gas has now to compete with electricity as an illuminant, "while in many cases it has been superseded by mineral "oils which are now so abundant and cheap. If, however, "gas is losing ground as an illuminant, it seems to be "gaining ground as a source of power, and there are pro-"spects of a considerable increase in the use for this "purpose of hydrogen and its compounds containing far "less carbon than ordinary coal gas." Much of this is mere repetition of popular notions which should only have been referred to by the President of the Society of Chemical Industry for the purpose either of corroborating or confuting them by precise statements of fact. It is, of course, true in a sense that "gas has now to compete "with electricity as an illuminant;" but if Sir John Evans had taken the trouble to inquire what this competition means, even in the case of the city in which he had to speak, he would have learnt something that would surely have prevented his later admission that "gas is losing "ground as an illuminant." Then as to the observation about gas being "superseded" by cheap mineral oils, we altogether deny the appropriateness of the word in connection with this subject. The supersession of one thing by another is a very different process from the competition of the same two things. Cheap mineral oil lamps certainly do compete sharply with coal gas as a

lighting agent within certain limits; and this is a good thing for the gas industry, which is thereby held down to a very obvious comparative standard of value for its main product. Some people prefer oil for lighting because of its cheapness; others for æsthetic reasons. In the great field of artificial lighting, however, oil though never so cheap cannot touch gas; while gas can, and does, oust oil even on the score of economy, when steps are taken to place it within the reach of the cottager. Thus to talk of oil superseding gas because there is a market for it alongside the latter commodity, is nonsense. If Sir John Evans needs an example of one system of lighting superseding another, in the proper sense of being unquestionably and universally preferred to it, he can take the electric lighting of ships; and we shall not quarrel with him for so describing the process of the disuse of oil-lamps and candles in this connection. With regard to the kind of gas that Sir John Evans seems to think best suited for supplying power, we are disposed to agree with him, so far as we understand this passage of his address. Certainly, if gas is to be made specially and wholly for supplying motor engines, it is not ordinary coal gas that will be found most suitable for the purpose. It is truly remarkable, however, how apt the most intelligent speakers and writers upon this subject of power generation by means of gas are to go astray from the right data, and to confuse the economical qualities of common town's gas and producer gas. A gentleman who has recently ventured into this particular field of controversy—Mr. A. W. Brown, of Edinburgh—argues for a system of fuel-gas distribution for Edinburgh, with a view to the utilization in this way of the inferior coke produced at the city gas-works. Mr. Brown thinks that this gas could be employed for generating electric light, and would also serve for cooking and heating in the poorer parts of Edinburgh. He starts fairly enough with the fact that an engine can be driven more economically with producer gas made from coke than by steam; but, like so many others, he ignores the difference between the cost of producer gas as manufactured and as distributed. He asserts that this kind of gas "can be *delivered* in considerable quantities to "small or large electric stations at the cost of about 2d. "per 1000 cubic feet." We have italicized the principal word in this sentence; and we engage that if Mr. Brown will take the trouble to look into the full meaning of this word, he will alter his views upon the general subject. With regard to the use of inferior gas coke in producers serving engines, moreover, additional information is desirable; for we noticed that the best Welsh anthracite is not considered too good by people in this line of business.

The End of Two Celebrated Cases.

Two matters of legal and technical interest call for notice to-day; and they may be referred to here in a single paragraph, with a view to the saving of space. In the first place, it will be remarked with satisfaction that the litigation in what has come to be known as the gasholder patents case has been settled, and the appeal to the House of Lords has now been withdrawn by consent. The nature of the settlement has already been reported in the JOURNAL; and on Thursday last the House of Lords were asked by both parties to discharge the injunction that was granted by the Court of Appeal against Messrs. Ashmore, Benson, Pease, and Co., Limited. Thus ends a regrettable incident in the development of the modern gasholder; and we sincerely hope that henceforward nothing may arise to stand in the way of the progress of those clever and admirable systems of gasholder construction and guiding with which the names of Messrs. Gadd and Mason and Messrs. Ashmore, Benson, Pease, and Co., Limited, are respectively identified. The next matter is the result of the reference of the nuisance action of Chapman and others against the South Metropolitan Gas Company to Mr. Ridley, Q.C., for the assessment of damages. In this action, though the proceedings were very long, and the evidence on both sides was voluminous, the Judge's decision turned upon his own observations made on the spot rather than upon any other considerations brought into Court. This opens up a vista of cheap adjudicature that has not been sufficiently regarded. How nice it would be if, in all disputes of this or any other kind, involving questions of fact as well as of law, a simple method of procedure could be adopted, whereby, after Counsel on both sides had told their tale, and the litigants had explained their respective positions, the Court should proceed to satisfy itself by inspection as to how the matter stood, and should then decide the case, leaving a Referee to settle all questions of account! This was really what was done in the case in point; but only after a posse of expert and other witnesses had been encouraged to darken counsel. However, in the end, the case has so far been satisfactorily disposed of. The principal plaintiff, we understand, claimed upwards of £1000 damages; and the amount has now been cut down to £450. Seeing that the verdict did not carry costs upon the higher scale, and that the hearing lasted ten days, it is not probable that the net profit to be made out of these proceedings by the plaintiff, according to this report, will be large enough to encourage similar litigation in the future.

Settlement of the Accrington Dispute.

THE much-debated Accrington Gas and Water Bill has now arrived at the haven of an agreement between the parties; and the undertaking of the Company is to be purchased by the opposing Local Authorities upon terms which will be found detailed in the report which appears in our "Parliamentary "Intelligence." It will be remembered that the course of this measure, which in itself is of a very ordinary character, was troubled by opposition of a kind which is happily very uncommon; it being alleged, on the part of the Accrington Corporation, that the accounts of the Company had been manipulated to the prejudice of the consumers. It turned out, upon investigation, that this charge referred mainly to an old question of accountancy—the allocation of charges as between revenue and capital. At one time the Corporation seemed inclined to go further, and accuse the Company of having indulged, for their own purposes, in a system of fictitious entries. But this was not seriously gone into; and the later proceedings before the Committee drifted into a mere playing off of one accountant's opinion against that of another, which is rather less interesting than a conflict of engineering opinion. All this part of the case was pushed aside, however, by the announcement that the parties had agreed to a settlement on the basis of purchase; and Counsel made a handsome acknowledgment that no charge was ever intended which would reflect upon the personal honour of anybody connected with the Company. The opponents of the Bill elected to use a certain weapon forged out of the accounts of the Company; but it was admitted that there was really nothing more in this than might be furbished up for a similar purpose from any other Company's books. It is quite right and proper that such an explanation should be offered; and the Chairman of the Committee did all that could be expected of him in congratulating the parties on the settlement, and the withdrawal of all imputations as to the manner in which the books had been kept. All the same, this is not a pleasant or a creditable way to fight a Bill; and we trust the precedent will not be followed, unless the issue is intended to be fought out to the end. The unregenerate man is apt to look upon accusations of falsification of books as lying beyond the licence of counsel, and to regret that a reference, from the tongue of a lawyer, to the "secular arm" is not permitted in these polite times. The least the Directors of the Company can do is to signify in some practical way, before the property passes out of their control, their satisfaction with the conduct of those who have suffered obloquy for their fidelity to the interests of the undertaking.

A Workmen's Exhibition.

THE fact that the London Trades Council recently took it upon themselves to organize a Workmen's Exhibition at the Agricultural Hall, in Islington, with a view to encouraging the individual handicraftsman, has been commented upon in various ways by the newspapers and certain of the technical journals. One of our contemporaries pertinently remarks that if a tithe of what has been alleged against the Trades Unions in the past is true, these organizations have done much to quench enthusiasm in their members, and to reduce them all to an average of mediocrity. Again, it is observed that if "trade unionist" and "conscientious workman" ever grow to be regarded as at all synonymous terms, the power of the Unions will become enormous; and they will have done a work of inexpressible importance. We mention this observation here in order to have the opportunity of putting on record our hearty and unreserved agreement with it. We have published many hard things concerning Trades Unions and Trade Unionists in the past, and have been

regarded as bitter enemies of both. But this is not so. It is only the folly, the wickedness, the tyranny, and the shortsightedness of Trades Unions and those who are most prominently identified with these societies that we have denounced and exposed. The union of workmen is a grand idea; but the worst of it is that, when workmen do unite, it is so often the talkers and the most worthless among them that get hold of the reins of power, and waste the strength of the Union in furthering crack-brained socialistic schemes, or in supporting some silly "principle" or some turbulent official against every dictate of common sense and public policy. It is a splendid plea of the London Trades Council that, in holding a Workmen's Exhibition, their object is to to encourage individual proficiency and reliability; but it is open to be argued that the suppression of the individual is the basis of Trades Unionism, and that regard for individual merits is incompatible with the spirit of trade organization. During the pre-factory age, when the character of every workman was known to his employer, and he was paid accordingly, there was no room for a trade society. Long after the aggregation of mechanics and labourers in workshops had become an accomplished fact, there were many grades of pay for men ostensibly in the same kind of employment. The tendency of trade organization has been to do away with this state of things, and to level wages as well as effort. There is something to be said for this policy, which joins the "Union stroke" to the Union rate of pay; for the Society leaders might argue that, with the increase of the size of factories and the extension of machine work, it becomes well-nigh impossible for the individual tradesman to make his mark, and so it is better for all parties to accept the standard of the Society in place of that of the individual. This being granted, where is there room for such "rare birds" of superior workmen as inconsiderate Nature will persist in occasionally turning out, to confuse all arrangements depending upon the average mediocrity? Obviously, outside the Society. It has always been a maxim of Trade Union management that "the duffers "must live as well as the others." If this genial rule is to be abandoned, the unfortunate "duffers"—that is to say, a goodly proportion of the whole body of any trade—will find no advantage in subscribing to the funds of a Society. And since no Society can benefit an exceptionally gifted worker, for whom are Trades Unions to exist? This is a problem that needs thinking over by Union leaders, in the intervals of their political and economical exercises.

English Capital and American Gas Undertakings.

COMMENTS have from time to time appeared in these columns upon the craving for English capital of certain operators in the speculative gas industry of the United States; and we have incurred no little obloquy for the persistence with which we have warned off British investors from this hazardous risk. It has been a dream of a few Wall Street geniuses to create as much partiality in England for American gas syndicates as the notorious brewery syndicates were greeted with in their day. This is all very well as a matter of financial business; and if the same class of people who gambled in beer like to try their luck with gas, they will not be hindered from "backing their fancy" by anything that appears in a technical journal. All that we are concerned for is to preserve in the minds of regular readers of the JOURNAL the distinction between the nature of gas shares in the United States, where the most apparently stable undertaking is at the mercy of the "raider" and his tools in corrupt municipalities, and the same description of scrip relating to countries where there is something like respectable gas-works administration and regulation in the public interest. We recently noticed a passage in a financial article appearing in an American technical contemporary, which stated complacently that "the fallacy of the idea "of electricity damaging gas profits" having been dispelled, "efforts will be made to bring the English investor "into several schemes immediately." There is no doubt about the latter circumstance; but there is something peculiarly "childlike and bland" about the prefatory pretence that the coyness of the English buyer of gas stocks towards the American product is due to fear of electric lighting. We have that at home, and know the extent of it; but what English capital really fears is the madness of competition, the municipal order to sell gas at any price that may seem reasonable to the popular mind, and the other endemic diseases of the great American gas industry, for which there is ceaseless "quacking," but no prospect of permanent cure. So long as these things persist, the prudent capitalist will be content to leave the industry to those who have a first-hand acquaintance with it. No "foreigner" can pretend to understand the great American gas question; and it is accordingly a very proper matter for home attention. American gas engineers are the best of good fellows, as we have repeatedly acknowledged. But they have their own game to play; and while it would be presumptuous for an outsider to tell them how they ought to play it, there is no injustice in requiring them to find their own stakes.

WATER AND SANITARY AFFAIRS.

THE London County Council are entering into comprehensive arrangements for the purpose of spending any money placed at their disposal by an indulgent Parliament, relative to the water question, and are engaged in a general policy of "fuss," in order to make it appear that things will never be right so long as the Water Companies are allowed to retain their post. It matters not that there is a Royal Commission about to report on the subject. The Council feel that it depends upon them to decide what is to be done, and how to do it. Accordingly, they are now going to work in earnest. They have converted their Special Water Committee into a Standing Committee, to signify that—come what will—they are determined to keep the question of the Metropolitan Water Supply under their perpetual observation. They have engaged a "financial "expert" (we presume a Chartered Accountant) to look into the accounts of the Water Companies; and for this little service £250 are to be expended. There are also to be sundry geological experts, to assist Mr. Binnie in getting at a right notion concerning "certain areas" where it is said a considerable quantity of water is to be found. This notable exploit is good for £500. Mr. Binnie has already presented the Special Water Committee with "an important report;" but something still more important is to follow, when the £500 have been spent. The Council are anxious to "safeguard the interests of the "ratepayers;" and it is well they should say so, or we might think otherwise. The experts (financial and geological) may rejoice in the golden shower about to descend upon them; but we cannot see as yet how the ratepayer is to be benefited. As for finding water, the Council may learn of the Water Companies, who have succeeded in satisfying London's thirst through the fearful heat and drought of this exceptional summer. The average daily supply last month rose to the enormous pitch of above 214 million gallons—preceded by an average exceeding 207 million gallons in May. Of the May supply, General Scott shows that 18 per cent. came from springs and wells. The rivers have not run dry; and the underground sources have not failed.

The remarks which appeared in the JOURNAL for the 4th inst., on the subject of sinking funds in connection with water undertakings, dealt with the Manchester case, in which the Water Committee have achieved a financial feat which locally has been much applauded. But it is well to remember that the question may assume another aspect. The position of affairs in regard to the Dundee Water Commission, as mentioned in the same number in the "Notes from Scotland," is scarcely calculated to evoke even a modicum of enthusiasm. On making up the estimates of the income and expenditure in Dundee, it is found necessary to raise the domestic water-rate from 1s. to 1s. 2d. in the pound. This jump of one-sixth in the rate is attributable to the requirements of the sinking fund. Until recently, the sum annually placed to the credit of the fund was £2500; this year it must be more than double that sum—*i.e.*, £5690. It is true that the higher water-rate is not without precedent in the locality; but possibly consumers may not find in that circumstance an all-sufficing consolation.

The Epsom Local Board have encountered a rebuff in their effort to check a system of waste of water that is far too common. The Board, as reported in our last issue (p. 97), summoned a consumer before the Magistrates for allowing water to run to waste through a hose on his lawn. It was proved that this went on upon more than one occasion, and that there was no one near the hose at the time. So far

as was reasonably necessary, no doubt, the defendant was entitled, by virtue of a special payment, to use the water in his garden. But is it reasonable and legitimate to let the hose lie on the ground, so that water, which in days of drought may be greatly needed by other consumers, simply soaks into the soil at one particular spot? The Epsom Magistrates seem to think this is quite a regular and proper proceeding. But we take leave to doubt it. Section 60 of the Water-Works Clauses Act, 1847, enacts that every person who shall draw off the water "from the "reservoirs or other works of the undertakers, or shall do "any other wilful act whereby such water shall be wasted," shall incur a specified penalty. The Magistrates, however, have practically imposed the penalty on the prosecution. Not only was the case dismissed, but the defendant was allowed three guineas costs. This is altogether extraordinary. If there was ground for the prosecution, no doubt a small penalty by way of warning to others would have met the requirements of the case. But, even if technically it was not a "waste" of water, the Justices might fittingly have dismissed the summons without costs. It was beside the point for the Chairman to advise the Board to issue notices warning people against permitting waste. Everyone knew of the recent drought; and the magisterial decision is a direct inducement to selfish consumers to do the very thing which the Chairman deprecated.

The second report to the Water Research Committee of the Royal Society, by Professor Percy Frankland and Professor Marshall Ward, deals in a very comprehensive manner with "the vitality and virulence of *bacillus* "*anthracis* and its spores in potable waters." It is satisfactory to find these authorities saying: "Hitherto no "pathogenic bacteria have been found in the Thames "water, either by other observers or ourselves." How, then, we would ask, is fault to be found with the water supply of London? Assuredly, it is exempt from the charge of disseminating zymotic disease among the population. Professor Frankland and his colleague have experimented on the waters of the Thames and Loch Katrine, by introducing into them the *bacillus anthracis* in three different forms, and under varied circumstances. The importance of the investigation is shown at the outset by the statement that the spores of this bacillus are among the hardiest orms of pathogenic organisms, to which fact it is due that their deportment under any particular conditions is of peculiar interest, as exhibiting the limit of endurance which has to be taken into consideration in dealing with pathogenic bacteria. Conditions which are found to be fatal to anthrax spores may in general be assumed as *à fortiori* fatal to other pathogenic forms. Among the non-pathogenic germs, there are a number even more hardy than the anthrax spores; but the *bacillus anthracis* is described as constituting almost "the extreme term" in the series of pathogenic organisms which are at present known. In the form of spores, it is especially hardy and refractory—capable of remaining alive for some time in absolute alcohol, and maintaining vitality when exposed for twenty-one days to a pressure of ten atmospheres of pure oxygen. Boiling for ten minutes the water containing such germs, cannot be relied upon for killing them. Sterile Thames waters were found to be still virulent nearly seven months after their infection with anthrax. But the degeneration of the spores is much more rapid in the unsterilized than in the sterilized water. The former is, of course, the more natural state of the stream; and the presence of the anthrax spores is in all cases—that is, so far as this report is concerned—the result of an artificial treatment of water which had no such spores when taken from the river. In the sterilized waters both of the Thames and Loch Katrine, the sporiferous anthrax bacilli are reported to maintain themselves in practically undiminished numbers for many months; and their multiplication appears to have been greater in the Loch Katrine water than in that of the Thames. But in every instance the germs had to be introduced. They were not found naturally in the waters.

A very important part of the investigation is that which relates to the action of sunlight. The effect thus produced is said to have been most marked in the destruction of the anthrax spores in the unsterilized Thames water. In the unfiltered water, these spores were no longer discoverable by cultivation after 84 hours' exposure to sunshine. They had "perished to the last individual." The spores are "immensely more resistant" than the bacilli. In the dark, and at moderate temperatures, the anthrax spores retained their powers of germination and infection for many months—proof is given up to eight—in any of the waters experimentally treated. But in direct sunlight, the spores undergo rapid destruction, depending on the intensity of what is termed the "insolation." It is also clearly shown that this destruction is due to the light-rays, especially at the blue end of the spectrum, and not to a rise of temperature. The rays of a winter sun are sufficient for the purpose, at temperatures so low that no question of heat can come into consideration.

Such are some of the conclusions arrived at, based on a mass of observations and experiments possessing the highest value on the subject to which they refer. The critical question, whether the bacilli of anthrax can grow and multiply, or form spores, in the water dealt with by the investigators, is answered by the statement that such development is "possible only under special conditions." We are at the same time given to see that there are "conditions" of an ordinary character which help to promote the purity of our water supply. Sanitary science is largely indebted to the joint authors of this report, for the patience and skill with which they have conducted a laborious and difficult inquiry. They have, as they venture to suggest, attained results which "may serve as a "basis for practically assessing the higher limit of possible "vitality which may be exhibited by pathogenic micro-"organisms gaining access to potable water." The line so drawn is one within which London is found secure.

The Alkali Act Report.—The report of the Chief Inspector under the Alkali, &c., Works Regulation Act, 1881 (Mr. A. E. Fletcher), for the past year was issued yesterday; and we shall give next week our usual extracts therefrom.

Title-Page and Index to Vol. LXI.—The title-page and index to Vol. LXI. of the JOURNAL (January to June, 1893) will be ready in a few days; and, as usual, a copy will be forwarded post free by the Publisher, on receipt of a post-card from any subscriber.

Presentation to Mr. R. H. Shankie.—Last Thursday, Mr. Ramsay H. Shankie, gas examiner at the New Street works of the Edinburgh and Leith Gas Commissioners, was presented, in the presence of the workmen, with a gold albert, a travelling bag, and "King's Treatise on Coal Gas." Mr. R. Mitchell, in making the presentation, referred to the services of Mr. Shankie, who, he said, had graduated in the profession under him, paid tribute to his qualities, and expressed his sense of loss at Mr. Shankie's departure. Mr. Shankie has been appointed Works Superintendent at Iquique, Chili.

The Appeal in the Gadd Case.—Last Thursday, the House of Lords formally disposed of the appeal of the Manchester Corporation against the judgment of the Court below in the Gadd and Mason case. Sir Horace Davey, Q.C., explained to their Lordships that the parties had come to an agreement; Messrs. Ashmore, Benson, Pease, and Co., Limited, having arranged with Messrs. Gadd and Mason for the purchase of their patent No. 18,119 of 1888, on condition that the injunction granted by the Appeal Court should be discharged. The costs already paid to Messrs. Gadd and Mason under the order of the Court were to be retained by them in full satisfaction of all claims and demands in respect of all gasholders or parts of gasholders now erected or contracted for, in infringement or alleged infringement of that patent, by Messrs. Ashmore, Benson, Pease, and Co., or the use thereof during the term of the patent; and the respondents undertook not to bring any action in regard thereto. A formal order of the House was necessary for the discharge of the injunction; and the parties agreed in asking their Lordships to make it. The application was granted.

The Southport Corporation and the Assessment of the Gas-Mains in Birkdale.—In the Queen's Bench Division of the High Court of Justice on Monday last week, Justices Cave and Wright had before them an appeal by the Corporation of Southport on a special case stated for the opinion of the Court on the question of the assessment of the mains supplying Birkdale with gas, under the provisions of the Southport Improvement Act, 1871. The Corporation, it may be remembered, have the use of the mains (which were laid and are kept in repair by the Birkdale Local Board), subject to the payment of 3½d. per 1000 cubic feet for the privilege, and a further sum of 4½d. per 1000 cubic feet on the quantity of gas used by private consumers. The question raised was as to whether the Corporation were liable to be assessed to the poor-rate in respect of these mains. Counsel for the appellants contended that the right to send gas through the pipes did not create an occupation, but was merely an easement. The respondents, however (the Assessment Committee of the Ormskirk Union and the Birkdale Local Board), argued that, inasmuch as the Corporation had the exclusive right to use the pipes, they were liable to be rated as occupiers. Their Lordships yesterday gave judgment for the appellants.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 141.)

THE past week has been a period of extreme depression on the Stock Exchange. It opened badly, with the failure of a large Australasian financial undertaking (dragged down by recent Bank suspensions), and proceeded with a general fall in almost all descriptions. Things went from bad to worse, as the margins on stock pledged to cover advances ran out, and the securities were thrown on markets already almost devoid of buyers. The settlement was looked forward to with the utmost apprehension; and the degree of alarm entertained may be gauged by the fact that, when it appeared that only ten members would be unable to meet their liabilities, a feeling of relief was experienced. Others, who were confidently expected to fail, were helped through their difficulties. Altogether, it has been a gloomy time; and unfortunately the outlook ahead is not promising. The Money Market remains in the same position of easiness. The supply is abundant, but it cannot find employment; and, so far as present indications extend, there is no sign of approaching change. It is a cheering diversion to turn to the Gas Market, and to note how it almost enjoys an immunity from the troubles that beset other departments. Although not absolutely free from slight shrinkage of values here and there, the advances in price made by some issues are more than sufficient to balance them. Business has been extremely quiet; and one might fairly have expected a greater falling off in quotations than is the actual case. Gaslight "A" is higher by one point; and transactions throughout the week showed very steady figures—the opening and closing mark being 227½. A full proportion of business was done in the secured issues (the demand for safe investments being a marked feature in these days of doubt and distrust); and some of them rose in value materially. South Metropolitans were almost neglected; but the debenture stock is quoted higher *ex div.* Nothing important was done in Commercials. The old stock was put down 2—owing, we believe, to a quantity of stock being sent into the market by trustees who had to realize. The Suburban and Provincial undertakings were very quiet and featureless. Of the Continentals, Union and European were firm; but Imperial was easier, and fell back 2. None of the other Companies offered any noteworthy incident. The Water Companies were extremely quiet, and almost unchanged—only Lambeth improving 1, and East London losing to a similar extent.

The daily operations were: The Gas Market opened on Monday in a very inanimate condition, and nothing was done all day but two or three deals in Gaslights. Business was not much more brisk on Tuesday; but quotations showed more change. Gaslight "A" rose 1; and ditto 6 per cent. debentures, 3. But Commerical old and Imperial Continental receded 2 each. East London Water also fell 1. On Wednesday, business relapsed again into almost a state of stagnation; but an advance of 1½ was made in Gaslight "K." Thursday was comparatively much more active, and prices in general were pretty good. Cagliari and South Metropolitan debenture figured higher *ex div.* Lambeth Water rose 1. Matters remained in much the same position on Friday; what few issues were dealt in being firm and unchanged. Saturday was quite as busy as the average of the week; and all quotations closed without further variation.

ELECTRIC LIGHTING MEMORANDA.

The Uncommercial Character of American Electrical Ventures—Cheap Incandescent Lamps in November—The Electric Lighting Venture of the St. Pancras Vestry—The Royal Marriage Illuminations.

SOME strong comments are made in the *Engineering Magazine* on the uncommercial character of many of the electrical enterprises in the United States, the multiplicity of which backward foreigners are continually being bidden to admire as an indication of American progress in electrical industry. It is stated that the construction of electric street railways is the subject of a "craze" in the States, and that these conveniences are being exploited in many localities where there is no chance of their proving remunerative investments. It is the same with the electric lighting industry. It is remarked, in illustration of the recklessness with which these electrical speculations are started, that the customary fare on an electric car must be 5 c., irrespective of the actual cost of the service rendered; and in like manner the price of electricity for lighting purposes has somehow become established by custom at 1 c. per ampère-hour. While it is possible these rates might be found to be fairly remunerative in some large cities or under exceptionally favourable conditions, the returns of the Massachussetts Gas and Electric Light Commissioners show that the price is a ruinous one for the smaller electric lighting companies, and that most of these, taking into account the inevitable depreciation of their plant, must be falling more and more behind with every year of their existence. It is on record that of the 84 companies engaged last year in Massachusetts in supplying electric light and power, only 16 have been able to pay dividends after the rate of 6 per cent. and upwards, while 61 companies have not paid any dividend at all. More than a million dollars, sunk in electric lighting enterprises in this one State, does not earn 1 per cent. per annum; leaving the cost of repairs and renewals altogether out of the question. This condition of affairs can only end one way.

It is expected that when the British master-patent for incandescent electric lamps expires, which will be on November 11 next, there will be a great and sudden drop in the market price of these articles. Apart from all considerations of covering patents for minor details of construction, fitting, &c., it is unquestionable that on the date stated, this country will be thrown open to traders in all sorts and makes of incandescent lamps, while the Edison Company will have to come down to about one-half of their existing rates in order to retain their customers. Most of the cheap lamps that will invade the country in November will be "made in Germany," where there is already competition in this manufacture; but the United States will also try to secure a share of the English trade. Notwithstanding all that has been said as to the impetus which the cheapening of lamps ought to give to the British electric lighting industry, we doubt if the effect will be noticeable. The Edison lamps at 1s. 6d. will, in all probability, hold the market against their German rivals at 1s., because it will be easy to arouse in the mind of the consumer the suspicion that an over-cheap lamp means an extravagant use of current. Moreover, the principal users of this class of goods are not likely to feel the reduction by 50 per cent. of the cost of a lamp that goes for 1000 hours. There is more to be said for the view that with cheaper lamps the lighting is likely to be more brilliant, inasmuch as it will pay to push the lamps harder; but speculation upon the consequences of the great event of November for the electrical world may easily become extravagant. The electricians themselves have been very fond of prophesying all sorts of things concerning the future of the electric lighting industry. Now is their time for prophesying in a matter that offers a hope of speedy verification—for which reason they will probably keep silence on the subject.

The electrical party in the St. Pancras Vestry are not to have everything their own way; for a recalcitrant member of this body, who evidently does not admit the authority of the Vestry Clerk and Professor Robinson, has ventured to issue some remarks challenging the optimistic statements relating to the position and prospects of the local electric lighting venture which have emanated from these two official apologists. This critic has set himself to prove that, so far as they have already gone, the Vestry have spent £100,000 upon an installation that was expected would cost only £50,000; and that, instead of making the large profits promised to them by their advisers, the Vestry lost £6500 by the speculation last year and will probably lose £6500 more this year. To this impeachment an answer is to be prepared by Mr. Gibb and Professor Robinson, to which we promise to pay full attention. The question is an urgent one for the Vestry, inasmuch as an addition to the electric lighting plant has been proposed, and there is naturally some curiosity in the parish to learn how the completed portion of the undertaking is doing. We speak of a portion of the plant as being completed; but this is hardly correct; for the installation is like all others in manifesting the most pronounced hostility to a closed capital account. There is always something wanted to make these electric undertakings complete.

Touching upon the question of the use of incandescent electric lamps for the Royal Marriage illuminations in the City of London, as discussed in this column last week, it has been stated that the display at the Victoria Street offices of the Edison and Swan Company consisted of an "immense radiating star, bulging to a central circle enclosing the letters V. R. and G. M." The star points lay within a circle about 17 feet in diameter, and it was fitted with a thousand 8-candle power lamps of various colours. To supply the current to this triumph of the electrician's art, special leading wires had to be laid from the mains of the London Electric Supply Corporation at Deptford. Whether these special wires went all the way from Victoria Street to Deptford, or only from the office frontage to the street mains, is not clear. At any rate, the intrinsic superiority of this style of illumination to that of gas or even oil-lamps is not so apparent as the superior costliness of such an arrangement. When the South Kensington Exhibition Authorities were squandering their funds upon electricians at the rate of £10,000 a month for the illumination of the grounds and buildings, a great point was made of the effect of the simultaneous starting into light of the thousands of tiny incandescent lamps that were used for lining out the architectural features of the buildings, &c. This effect was doubtless worth something in the scheme of illumination; and the electric lighting companies stand convicted of remissness, or something else, in respect of their neglect of the opportunity provided on the 6th inst., which might so well have been used to show that electrical illumination did not reach its highest point at South Kensington six or seven years ago. As it was, the share of the advertisement offered by the popular night rejoicings that came to the London electric lighting companies was out of all proportion to the millions of capital these have spent in placing themselves in the position whence they displayed their "masterly inactivity" on this occasion. This failure will perhaps be explained, as all failures are; for, as a popular satirist has remarked, it is only the successes that explain themselves.

THE ART OF COMPOSING ENGINEERING SPECIFICATIONS.

Not long ago, Mr. Theodore Cooper, a member of the American Society of Civil Engineers, and an eminent constructor of bridges, &c., addressed the students of the Rensselaer Polytechnic Institute on the important subject of engineering specifications. If anything could add to the speaker's reputation as an engineer, this address, which is published in full in the *Polytechnic*, would do so; for, alike in spirit, style, and matter, it is so admirable, that we cannot bring ourselves to deprive readers of the Journal of the advantage of learning some of Mr. Cooper's views respecting one of the gravest cares of the engineer—that is, the specification of his designs in the best possible manner. Mr. Cooper has had great experience; and in his address the result of practice reacting upon conspicuous common sense and trained ability in engineering business, is set forth in the happiest and clearest language. He passes in review all kinds of engineering work, and every method of executing it; and he concludes in favour of the contract system, which will perhaps be a comfort to a much-abused and occasionally misrepresented class. The importance of the study of specification-writing, however, does not depend wholly upon the continuance of the contract system, for when work is done at first hand there is just as great necessity for explaining the manner of carrying out plans, and stating the nature and quality of the materials to be used, as when these instructions are to be carried out by a middleman.

Upon the supposition that a contract for any particular piece of engineering work is to be let, in the usual way, the first consideration insisted upon by Mr. Cooper is that the price should be such as will give "the expectation of a reasonable profit to the contractor." This is not to be understood as meaning that the contractor ought to have a profit in any or all circumstances, but only when the condition is observed of a proper and economical execution of the work. "I think you will find it the universal testimony of experienced engineers," says Mr. Cooper, "that, were it within their power, they would never allow a contract to be made which did not contain the expectation" already stated. The speaker was at particular pains to lay stress upon this expression of the business principle in contracting, because, as he says, it is not always kept in mind by professional men, some of whom regard the contractor as the natural enemy of the engineer. In preparing the estimate of any particular piece of work, it is the duty of the engineer as well as of the contractor to add to the approximately known elements of cost the reasonable contractor's profit, and also a contingency allowance "proportional to the risks involved and to the unknown elements entering into the execution." Failure to recognize this principle is a source of great injustice as between the parties to a contract. Where the principle is recognized, it becomes incumbent upon the engineer to reduce to a minimum the unknown influences that affect the proportions of the contingency allowance. This means "a well-designed plan, a thorough study of the local conditions, and a carefully-drawn set of specifications based upon the theory of possible contingencies"—engineering, in the full sense of the term.

Engineering specifications are defined by Mr. Cooper as consisting of the "detailed particulars supplementing and explaining the plans of any piece of work, and governing the character of the materials and the methods of construction to be used for the same." The object of a specification is further defined as being twofold. In the first place, it is intended to enable tenderers ("bidders" in the American) to understand fully the character and extent of the work, and what they are expected to supply and to do, in order that they may be able to make suitable estimates upon which to formulate an intelligent and proper tender. Secondly, it is intended to serve as a reference to the plans, in regard to all questions of qualities of material and workmanship during execution, in order to prevent misunderstandings between the engineer and the contractor. Nothing serves better, says Mr. Cooper, in obtaining the best class of contractors and obviating friction between engineer and contractor, than a good specification, carefully and clearly expressed. On the other hand, a loosely-drawn and incomplete specification is always an attraction to the worst class of contractors, or those who have no intention of doing an honest job, but will take advantage of every weak point to get all they can out of the contract. Such men frequently tender low for jobs when they see a weak specification, trusting to make "extras" later on, or to be able to smuggle in cheap material or work.

It is the duty of the engineer to place before the contractor all the facts he may possess relating to the conditions under which the work has to be executed. Both engineer and contractor can, and must, form an estimate of the possible risks. The contractor's estimate of his risks will affect his tender; and it may become a question how the liability for them shall be borne as between the parties. If the contractor takes an extravagant view of the risk, it is sometimes better to relieve him of it in some shape, in order that the ultimate cost of the job may not be swollen by an allowance for contingencies that may never occur, but which a prudent man of business could not afford to ignore. Mr. Cooper lays great stress upon a matter that is to the full as important in England, with our many local customs, as it can be in America. This is the classification and nomenclature of materials used in engineering and building construction. Where there are several classes of materials and workmanship which are to be paid for at different rates, it is very essential for every class to be properly and clearly defined in language intelligible to a master workman. There is no general classification of materials or of subsoils of universal application; and in excavation, where different kinds of substances are required to be dealt with at various prices, the line of demarcation is to be defined "rather by the relative difficulties of removal of the material than by any of the ordinary definitions or acceptations of these terms."

The use of such general terms as "first-class material," and "best workmanship," &c., as Mr. Cooper says, carry no weight except where they are expressly defined, or are taken in connection with other definite clauses. The average contractor is quick to discover the engineer's want of knowledge of the terms employed in his own specification; and is not unlikely to take advantage of such weakness, if he is an unscrupulous man. All this trouble is avoided when specifications contain plain directions, and the engineer is competent to tell whenever these are being infringed. Mr. Cooper discourages the use of ambiguous terms, and the laying of traps for contractors—denouncing the latter as a dishonourable practice. We have met with instances of engineers who were cunning rather than clever, who had a trick of specifying something which they could hold *in terrorem* over a contractor's head, and could insist upon or not as the contractor might happen to please them. This is bad practice; but it is difficult to lay down a hard-and-fast rule as to the extent to which "give and take" may be carried in the interpretation of specifications. Mr. Cooper puts the matter upon the broad footing of equity; laying it down as an axiom that "the contractor has his rights, and the engineer who fails to give equal consideration to the rights of his employer and the contractor in the execution of any work, falls short of a duty." He goes on to tell his auditory that the position of an engineer is something higher than that of an advocate or a partisan; and that while the engineer is bound to render loyal service to his employer, by devoting time and talents to his interest, such service is not to pass the bounds of truth, honour, and justice. One of the highest honours that a professional man can win is the attainment of such a reputation that both parties to a contract willingly accept his decision as final in all disputes.

This observation brings Mr. Cooper to the consideration of the vexed question of the reserve of disputes respecting the interpretation of a specification or the execution of work to the arbitrament of the engineer. He strikes the true note in giving it as his opinion that no engineer has a right to insert in specifications such phrases as "to the satisfaction of the engineer," or "as may be directed," to be afterwards used for obtaining more or better material and workmanship than would be expected from the context of the specifications. They can, however, be fitly used to cover work or material which could not in the circumstances be otherwise defined; or they can be used to relieve the contractor, under special conditions, by accepting some other material or work than is specified, if good reasons can be adduced for the change. Contingencies of this kind will often arise; and the great point to be borne in mind is that the reserve of reasonable discretion to the engineer is as much to the interest of the contractor as against him.

There is a very modern ring about Mr. Cooper's caution against specifying proprietary articles or processes, as somebody's paint or cement, somebody's valves or special mechanism. Usually, he remarks, the merits of any desirable material or process can be defined, so that if the engineer does happen to have a particular article in his eye there may be others, unknown to him, equally suitable and competent for the purpose intended. There is a natural tendency, as is admitted, for those who have had a satisfactory experience with some particular thing to desire to specify it for other cases; and the request to do so will be constantly pressed by interested persons. It is remarked, however, that this action tends to two undesirable results. In the first place, the engineer may be suspected of an interested motive; and, secondly, it may be thought that more is being paid for the article than would be paid in the open market. Mr. Cooper states that it is "sometimes admissible" to specify that materials or apparatus must be "equal in character and results" to some well-known article; and, contrariwise, that it is best to exclude an undesirable proprietary article by a well-defined clause stating the merits of the desired thing, rather than give an appearance of prejudice by forbidding its use. This is a little sermon on the text, "no Irish need apply;" and it is of the wisdom of the serpent. We may add to these remarks a protest lately uttered in an English technical journal against the slovenly habit, into which some drafters of specifications have fallen, of using the term "patent" as though it meant some special quality in the article designated—as "patent locks," "patent window fastenings," and so forth. The term is meaningless in this connection.

With regard to the general framing of specifications, Mr. Cooper counsels adherence to well-proved models, modified, if necessary, for the special purpose. The model must first be carefully studied, in order that its theory and general purport, as well as the meaning of the various clauses, may be understood. The wording of old and clearly-defined clauses is in no case to be tampered with. "A specification is not intended to be a treatise on the refinements of engineering theory, but a practical set of rules and conditions upon which work is to

be let and constructed. A specification should therefore be reasonably brief and positive." A general specification need not provide for all the special minor conditions and exceptional cases that may possibly occur in practice; but, on the other hand, an accepted model specification is to be regarded as an "accumulative growth," and will contain many requirements that cannot be safely set aside, though they may never come into operation in the case in point. It is therefore safer to maintain them than to create an exception.

Finally, says Mr. Cooper to all young engineers, be content to go on as far as you can in the old ways, by old methods, and with the use of well-tried and common materials. No specification that was ever drafted would get good and proper materials and workmanship if left to itself, or placed in the hands of inexperienced or incompetent persons to execute or administer. A specification, also, which contains any extra-refined, new, or severe demands, which the aspiring engineer has not the proper experience, time, or assistance to enforce, is a mistake; for it means that the employer will have to pay for something that there is no guarantee of his getting. While, therefore, special works of importance may justify the employment of new methods and new materials, it must be recognized that this means extra inspection and supervision, and a higher run of prices than would be required for customary methods and materials. "Do not," says this wise guide, "attempt to rush into new things, until you have exhausted the capabilities of the things which are readily obtainable. For general classes of work, you will find it better, both in time and money, to make use of the ordinary methods, and those materials which are accessible." These weighty remarks on specifications for engineering works deserve to be studied in every engineer's office in the world.

NOTES.

The Effect of Gases upon Plants.

Dr. T. L. Phipson has communicated to the *Chemical News* some results of experiments with carbonic acid and vegetation, undertaken for the purpose of testing the correctness, under modern conditions, of the late Professor Koene's views as to the constitution of the atmosphere at remote periods of the earth's history, to which reference was made in the JOURNAL for April 4 last (p. 586). Dr. Phipson has placed several varieties of hardy plants in an atmosphere of pure carbonic acid; and also in one composed of air with about 100 times more of this gas than exists in our atmosphere. All other conditions of vegetation were normal. It was found that the plants could exist for many days, or even weeks, in an atmosphere of pure carbonic acid; but they did not thrive. It is therefore highly probable, Dr. Phipson concludes, as Koene held, that in former geological periods (the coal age, for instance) there existed plants which could live in an atmosphere excessively rich in carbonic acid, and that the quantity of this gas in the atmosphere has really decreased from that time to this—the loss being represented by the vast deposits of peat, lignite, coal, and anthracite found in the strata of the earth. Experiments were next made with pure hydrogen gas, to see what would happen when plants are exposed to a gas which many look upon as the vapour of a metal. For the first few days, nothing peculiar was noticed. Then for a fortnight a slight bleaching of the leaves only was apparent. Three days later, a singular phenomenon occurred. The volume of the gas began to diminish; and in the course of a month the atmosphere of hydrogen was absorbed to the extent of about 80 per cent. The residue was not hydrogen; so that it may safely be said that the whole of the hydrogen had disappeared—the plant remaining perfectly healthy. Dr. Phipson explains this on the assumption that the nascent oxygen emitted by the leaves burns up the hydrogen.

A Durable Iron Pigment.

The lasting qualities of oxide of iron pigment have been testified to by Mr. W. J. Russell, F.R.S., in the course of a Royal Institution lecture upon certain colouring materials brought from Egypt by Mr. Flinders Petrie. It is of some moment, as Mr. Russell remarks, to know what pigments have resisted the action of air and light during from 4000 to 6000 years. One of the pigments much used on the outsides as well as the insides of the ancient Egyptian temples was a red, which is found to consist of 70 to 80 per cent of ferric oxide, the remainder being clay. It is, in short, an oolitic hematite. This hematite could not be rubbed down dry; but by rubbing in a mortar under water it could be brought into powder, and is then immediately ready for use without the admixture of any vehicle, for it will stick to the fingers, clothes, or anything else in an unpleasantly adhesive manner. Nitric acid has no effect upon this oxide. Mr. Russell painted a thin plate of iron with it, and then made the plate red hot. The colour grew darker under intense heat; but when the plate cooled, the paint resumed exactly its original colour. Mr. Russell accordingly declared this red oxide paint to be permanent and unfadeable in every sense. Attention is also called to an unfading yellow ochre, consisting of peroxide of iron combined with alumina, lime, and some water. The white pigment used by the Egyptians is a sulphate of lime, which has a greasy texture, and, being partially soluble in water, is not so suitable for damp climates.

Liming Coal for Coking.

Liming coal has been suggested again, this time as a means of hardening the coke. The process is attributed to Messrs. J. J. Fronbeiser and C. S. Price, of the Cambria Iron-Works, at Johnstown, Pennsylvania. It is remarked that, in the manufacture of coke from soft coal in retorts and ovens constructed to save the bye-products, the coke has the disadvantage of being more porous, softer, with more easily crushed cell walls, than when the same coal is coked in a beehive oven. To correct this defect, the above-named inventors first grind the coal to a coarse powder, and then mix with it a hydrate of lime (slaked lime) before it is charged into the retorts or ovens. Many substances besides lime will answer the same purpose, provided they will "satisfy" part of the sulphur contained in the coal, will unite with the free silica forming a silicate of the base, and by mechanical mixture will fill up the pores of the coke, thereby increasing its density. There is claimed to be an advantage in introducing into cupolas or furnaces, in combination with the coke, a fluxing material, such as is needed in the metallurgical operation therein carried on. It is found that an admixture of about 5 per cent. by weight of caustic lime to the powdered coal gives the best results; but a larger proportion can be added to coals containing more than 5 to 7 per cent. of ash.

The Pliability of Lead Joints.

The pliability of the lead joint is sometimes a great advantage to gas-mains; and a particular example in point is supplied by the experience of the San Francisco Gas Company, as narrated by Mr. J. B. Crockett to the members of the Technical Society of San Francisco. It was with reference to the Company's 24-inch trunk main, which supplied the southern portion of the city, and crossed a marsh for this purpose. The main was originally laid along the line of a projected "avenue," at a depth of 3 feet below the surface of the ground, where it remained for many years undisturbed. The time came, however, for the street to be "graded," which involved the necessity of raising the gas-main for a length of 1200 feet, in one place by as much as 18 feet of vertical movement. This was done by uncovering the pipe, and slinging it by chains to trestles of the proper height. The slings were attached to screws of the kind employed in lowering gasholders; and the pipe was raised turn by turn, with tap of hammer, in exactly the style familiar to gasholder builders. A gang of main layers kept an eye upon the pipe as it was being lifted, and caulked afresh such joints as required it. The alteration of level was effected without interrupting the supply of gas for a moment, and without causing serious leakage. The main was supported by trestle-work until the roadway was made up to the new gradient. Although the filling material settled a good deal, and the main was consequently subjected to great strains, and was thus moved bodily out of place several times—severely taxing the attention and resources of the gas-works officials—the lead joints appear to have acted most amiably. There was no such catastrophe as must have happened with any rigid method of jointing.

Honorarium to the Town Clerk of Plymouth.—At the last meeting of the Plymouth Town Council, the Water Committee submitted a recommendation that the salary of the Town Clerk (Mr. J. H. Ellis) should be at once raised to the maximum of £1000 per annum, in recognition of the services rendered by him in the successful promotion of the Plymouth Water Bill of the present session. After some discussion, the recommendation was adopted in an amended form, so that the amount by which the salary was to have been raised was given as an honorarium, to be charged, if possible, to the capital account of the Water Committee.

The Hygienic Value of the Incandescent Gas-Light.—The incandescent gas-light finds a far wider application in Germany than in this country, owing to the poorer quality and higher price of the gas generally supplied there; and it is there that the most careful observations of its working have been made. A recent contribution of Herr Reuk to the *Journal für Gasbeleuchtung* contains a criticism of the Auer incandescent light on hygienic grounds. He claims that it produces only one-half the amount of carbonic acid given off by an ordinary burner, and less than one-half the quantity of heat; while the products of imperfect combustion are so small in volume as to escape estimation. The great brilliancy of the light, combined with its steadiness and freedom from smoke, renders it superior to others; but its brilliancy demands the use of eye-protectors by those working under it. The rays of light are distributed in the same manner as from an Argand burner; and its illuminating power is far greater in a horizontal than in a vertical direction. For indirect lighting and for microscopy it is eminently suitable. Turning to its economy, Herr Reuk considers that it saves, on an average, 50 per cent. of the gas compared with flat and Argand burners, and 28 per cent. compared with regenerative burners. It gives a light double that of the Argand, and four times that of a flat burner. Consequently, it is not surprising that it has made great headway in a country where gas is notoriously dear, and small economies of consumption are of appreciable pecuniary value.

COMMUNICATED ARTICLE.

COAL GAS: ITS MANUFACTURE, DISTRIBUTION, AND CONSUMPTION.

A Series of Articles for Gas Students.

(*Continued from p.* 30.)

DISTRIBUTION.

Consumers' Meters and their Fixing.

The consumer's meter (from the Greek *metron*, a measure), by which the quantity of gas supplied to the individual consumer is duly measured, now claims attention. In the early days of gas lighting, when no reliable means of accurately measuring the flowing gas were available, the amount to be periodically charged for the gas supply was arrived at by computation; the data upon which the charge was based being simply the number of burners employed, and the hours during which they were in use. The irregularity of the hours of lighting, of pressures, and also, of course, the variation in the gas-consuming capabilities of particular burners, not to speak of the great facilities afforded for dishonesty offered by such a method, rendered this system as prolific in disputes and general dissatisfaction as it could well be. The difficulties thus necessarily incidental to its operation were still further enhanced by a ruinous competition, which, in the Metropolis and most of the important provincial towns, was in those days the rule rather than the exception. Upon the slightest pretext, a dispute might arise between a consumer and the supplying company, in which case the first step taken would be to have a new supply stealthily put in from the mains of a competing company, and the original vendors served with a peremptory notice to discontinue the supply. This was often done, probably at the instigation of an opposition company's official, without even waiting for the formality of an open dispute. The writer came across an amusing instance of these piratical practices some six years ago, where certain premises, having a wide frontage on one of London's main thoroughfares, were supplied with gas by means of a service-pipe which, connected to the front main in the ordinary way, was passed up a narrow court, run up the walls of premises many yards away, over the roofs of neighbouring houses, and finally entered the premises through the back window of a servant's bedroom, and was connected to a meter in an out-of-the-way corner a few feet distant. Needless to say, on its discovery, this service-pipe—evidently many years old—was promptly removed, and a connection made in the ordinary way at the front of the house.

Under such circumstances, it is not to be wondered at that the various undertakings met with but little or no commercial prosperity; and this continued until the introduction of a fairly accurate means of actually measuring the gas supplied—an introduction which met with no little opposition from the very-muchly interested consumer. The gas-consuming public and the trade were, however, and are still, greatly indebted to Samuel Clegg, Malam, Crossley, Richards, and other inventors, for the meter of the present day, although, of course, due credit must also be given for the important modifications and improvements which have since been introduced from time to time, with a view to rendering the instrument more accurate, reliable, and durable. The fundamental principle of the wet meter, however, remains still as it was left by Clegg and Malam—viz., the employment of a revolving measuring drum partially immersed in water contained in a tank or outer case.

A full description of the ordinary form of wet-meter drum will be found in the article on station-meters.* It was there pointed out that the accuracy of registration of the meter depends upon the maintenance of the water-line at the correct level; but the method adopted for securing this, as described in relation to the station meter, does not apply to consumers' meters. With one exception—the Warner and Cowan meter—all meters of the latter class are now provided with some special automatic appliance which is designed either to rectify or to compensate for, wholly or in part, such alteration of the water-line as must be incident to the ordinary working of the meter, being due to evaporation and other causes. Some meter makers are content simply to minimize the trouble by contracting the capacity of the drum about its axis, and increasing it towards the circumference. This plan considerably reduces the effect of any variation in the water-line, which, as already pointed out, is not far above the axis, and is fairly satisfactory where the meters can be periodically inspected and watered. Another, and more accurate, method is to provide an automatic arrangement whereby water is being continually transferred into the chamber in which the drum revolves from another independent chamber or reservoir contained in the meter case. This may be effected by bent tubes, scoops, or spoons, &c., which, connected to the spindle of the meter, revolve with it, and raise the water as before mentioned. An overflow-pipe prevents excess of water accumulating in the measuring chamber, as it conducts any surplus back into the reservoir. Crossley and Goldsmith's and Hunt's compensating meters have arrangements such as these.

A necessary provision in all these meters is the utilization of a small metallic float, which, connected directly or indirectly to a valve fixed inside the meter just below the inlet, rises and falls with the variations of the water-line. When the latter exceeds certain limits, either above or below the correct level—thus causing the meter to register excessively fast or slow, as the case may be—the valve is closed by moving the float, and the gas supply is stopped until the water-line is readjusted, and the float thereby regains its normal position.

Another arrangement embodies a different principle—viz., the displacement of water by a hollow float, as introduced in the Gas-Meter Company's unvarying water-line meter (Sanders and Donovan's patent). In this meter the ordinary chamber in front of the measuring chamber is provided with a semi-circular hollow metallic float accurately poised at its centre axis on pivots, the axes of which coincide with the correct water-level. This float carries a stop-valve. Being made one-half the specific gravity of water, it rises or sinks in exact proportion as water may be added to, or withdrawn from, the meter; and thus it maintains a correct level under varying circumstances. When the meter is empty of water, the float is suspended from the pivots, and the stop-valve referred to is arranged to rest against an orifice which forms the inlet passage for the gas; and the latter is thus stopped by the valve. As water is poured into the meter, the float rises, turning about its pivots; and it will continue so to do until water has been added to excess, and commences to overflow into the meter "spout" (described in the article already referred to)—thus again stopping the gas supply. This is rectified by draining the excess through a special plug orifice provided on the front of the meter case, near the bottom, which the student has doubtless often observed. The correct level being thus arrived at, the float attains its normal position; and as the water is reduced in quantity through evaporation or otherwise, it will gradually descend until, if meantime the meter be not attended to, the float will have arrived again to the point where the stop-valve closes the gas inlet passage, and stops the supply.

The most important modification of the wet meter has yet to be described—the Warner and Cowan patent drum. In outward form, and in the principle of its action, the drum of this meter is similar to that described in the article referred to above; but it differs from all others in this—that, in each of its revolutions, it delivers to the consumer a constant and unvarying volume of gas, irrespective of such variations in the water-level as do not exceed those prescribed limits beyond which the gas supply is automatically cut off by the float and valve arrangement already noted. In other words, so long as the water present is within these limits, the meter will continue to register with unfailing accuracy, and quite independently of the variations of the water-line. This is effected as follows: Inside the ordinary drum, and concentric with it, is another drum, the diameter of which is one-half that of the larger one, and which will here, for convenience, be termed the "wheel," as distinguished from the "measuring drum." This wheel is, in mechanical construction, precisely similar to the drum; but its chambers, inlet and outlet slits, &c., are arranged conversely to those of the measuring drum—the inlet passages being at the back, and the outlet passages at the front, of the wheel. The depth of the wheel—*i.e.*, from front to back—is about two-thirds that of the drum; the inlet passages at the back being open to, and fed from, the measuring chambers of the latter, while the outlet passages in front are open to, and communicate directly with, the inlet chamber of the meter, or "hollow cover." All gas, therefore, which enters the inner wheel is conveyed back to the meter inlet to be re-measured. The periphery of the wheel is above the water-level.

A little consideration should now enable the student to form a definite idea of the construction of this drum; and it will also render it apparent that the variations in the water-line will affect not only the capacity of the chambers of the drum, but also that of the wheel. It follows, therefore, that (say) a low water-line, which increases the capacity of the measuring drum, and thus operates in favour of the consumer, will also at the same time affect in like manner the capacity of the wheel, the contents of which are being returned to the meter inlet, and thus in this way will operate in favour of the company. On the other hand, a high water-line, reducing the capacity of the measuring chamber to the disadvantage of the consumer, acts in like manner on the wheel. Thus, by reducing also the quantity of gas that is returned to the inlet, it operates here in favour of the consumer, and to the disadvantage of the company. Further, the dimensions of this wheel are such as to render the capacity of its variable portion practically equal to the capacity of the variable portion of the measuring drum; and therefore both wheel and drum are *equally* affected by variations in the water-line, and the *plus* quantity in the drum is exactly equal to the *minus* quantity abstracted by the wheel. Hence, while both volumes—*i.e.*, those delivered into the wheel and the drum respectively—are variable according to the water-line, yet these variations are equal in both cases; and the one volume cannot vary without an equivalent alteration taking place in the other. Such excess of gas as is received by the drum owing to a low water-line is balanced by an exactly equivalent excess in the amount abstracted by the wheel, with the result that the net quantity of gas delivered by the meter continues perfectly constant and accurate. A high water-line operates in a reverse manner; but with a precisely similar result. Hence, as already stated, the registration of this meter is independent of the water-line; and should the latter rise or fall beyond certain limits, the float and valve at once come into play, and shut off the supply of gas, as already explained.

* See JOURNAL, Vol. LXI., p. 311.

Urquhart's "Reliance" meter, to which reference has already been made, is so constructed that the gas enters the drum direct from the inlet, and leaves it by the "hollow cover" and "spout," which in other meters serve as the gas inlet to the drum. The ordinary arrangement is thus reversed, and its effect is that the inlet gas pressure bears nearly equally upon the whole surface of the water in the meter; thus rendering the measuring conditions more independent of alteration of the inlet pressure.

From what has been said, the student will understand how it is that the gas "goes out" when a meter is either under or over charged with water. When any trouble of this nature occurs, the proper course is to first shut off the main supply-tap, then remove the right-hand plug on top of the front of the meter (just below the index-box), and also the plug at or near the bottom. Either see that one or more gas-taps are turned on, so as to place the interior of the meter under the ordinary atmospheric pressure, or disconnect the outlet of the meter (at the top of the case, behind the index-box), for the same purpose. Then add water through the first-mentioned plug orifice, and continue to do so until water commences to drain through the orifice below from a chamber or waste-water box, with which it communicates by a sealed tube, and into which all excess of water flows.

The number of revolutions of the drum are registered by the index by means of a worm, which, attached to the drum spindle, actuates a small pinion wheel and a vertical spindle, which is carried up through a stuffing-box into the index-box, where it actuates directly the train of wheels to which the dial indicators are fixed. A small metallic drum is usually also fixed on to this upright spindle, in such a position in the index-box as to be open to observation; and on it is graduated single cubic feet, by which ready indication may be given of the rate per minute at which gas is passing through the meter. In reading a meter index, no error need be made if it be borne in mind that the passage of the indicator from one figure to the next on each dial represents a complete revolution of the indicator on the next dial to the right, and cannot be read as at a certain figure unless the right-hand indicator has really completed its revolution. Thus, an index which, through the slightest defect in the adjustment of the pointer, may appear to indicate (say) 009 or 608, would in all probability be correctly read 999 and 598 respectively; because, although the thousands and tens of thousands indicators really do stand at 0, they should not do so, if perfectly adjusted, until the hundreds indicator stood at 0 also. This will be apparent if the state of the meter be again taken after (say) 400 cubic feet have passed through, when the index will be at 003 and 602 respectively; thus showing conclusively that the first-named readings were erroneous. This is an error easily fallen into, and one which beginners are very apt to make.

Wet meters should be fixed *perfectly level*, and in positions where they will not be subject to intense cold on the one hand, with a liability to having the water frozen, or undue heat on the other, causing the water to rapidly evaporate.

The dry or diaphragm meter now calls for attention. For the present important form of this meter, we are indebted to Mr. William Richards, lately deceased. It consists of an outer case, which is internally divided by a horizontal partition into two portions—the lower one being occupied by measuring chambers, the upper one comprising the valve chamber. The measuring chambers, two in number, consist of a central fixed diaphragm or vertical partition, which completely divides the lower portion of the meter, and, on either side, a moveable disc, which is connected to the central partition by a band of flexible leather; the three discs, with the leather sides, forming two circular collapsible chambers, which alternately are filled with gas and discharge it through the valves into the meter outlet. The reciprocating motion of these discs, as the chambers inflate and collapse, is converted (in part) into a circular motion in a vertical rod, by means of a hinged metallic strip. The vertical rod, passing upwards through a stuffing-box, enters the valve chamber, and there actuates mechanism which not only works the valves, but also, by a worm and toothed wheel, turns the index wheels. In the upper chamber (one over each measuring chamber) are the valves already referred to, each of which comprises a valve cover similar to the ⊏ slide-valves of an ordinary steam-engine, and ports over which they slide, which—three in number—communicate with the inside and the outside of the measuring chambers and the outlet of the meter respectively.

The method of working the meter is as follows: Gas enters by the inlet-pipe on the right-hand side, and is passing into (say) measuring chamber A. As this chamber distends, the gas contained outside it, between the moveable disc and the outer case of the meter, is being forced out through the centre port to the meter outlet. When fully inflated, the valve is reversed; and the measuring chamber commences to discharge its contents into the outside chamber, which is now closed to the meter outlet. The complete action of inflation and collapse is duly recorded on the index by the mechanism already referred to; and as the contents of the chamber, when fully inflated, is known, the gearing of the index is arranged accordingly. In the meantime, a similar action is proceeding in the chamber B, on the opposite side of the meter, but alternately with A; so that as the one measuring chamber is being inflated, and the outside gas expelled into the meter outlet, the other measuring chamber is delivering its contents into its outer chamber—thus preparing for, and ensuring, a continuous supply into the meter outlet. The arrangement of the valves is such that one side commences to deliver into the outlet-pipe before the other has ceased to do so. In this way, oscillation and jumping lights are effectually guarded against.

TECHNICAL RECORD.

SOCIÉTÉ TECHNIQUE DU GAZ EN FRANCE.

Annual Congress in Paris.

The Twentieth Annual Congress of the above Society was held in Paris from the 13th to the 15th ult., under the presidency of M. PAUL MALLET. The following particulars in regard to the meeting are translated from the *Journal des Usines à Gaz*, the official organ of the Society.

At the opening of the proceedings on the morning of the 13th ult., there were 107 members present. This was more than twice the number that attended the meeting at Tarbes last year. But, of course, the Paris congresses are always conspicuous for good attendances. The first item on the programme was the reading, at an extraordinary meeting convened for the purpose, of a report containing propositions for certain alterations in the rules, bearing specially upon the constitution and powers of the Committee. The amendments having been adopted, the extraordinary meeting closed, and the general business was subsequently proceeded with. The report of the previous meeting, as printed in the Transactions, was formally adopted; and the names of the new members and associates proposed for election were submitted and approved. Of the former, there were 23; of the latter, 11. The President of the Incorporated Gas Institute for 1893-4 figured at the head of the list, for election, as usual, as an honorary member. The report of the Committee on the progress of the Society was next presented by the President. It consisted mainly of notices of the eight members who had died during the year; conspicuous among them being M. Le Treust, Mr. H. M'Lauchlan Backler, and Mr. J. Hodgson Jones. The total number is now 604—composed of 21 honorary and 491 ordinary members, and 92 associates; being an increase of only 12 on the total in 1892. The President added his regrets to those expressed by his predecessors that the additions to the ranks of the Society are so few, and that certain of their former colleagues, who have now retired from active work, cease to take an interest in an industry to which they were attached for many years. Most of the gas companies continue to testify their appreciation of the objects and work of the Society; and they have forwarded their usual contributions to the funds. They amounted to 22,775 frs. (£911); and the President remarked that the financial statement about to be presented would show how necessary these donations were to keep the Society going. The Treasurer (M. Deleury) then submitted his report. It showed that at the close of the past year the capital had risen to 136,107 frs. (£5444); being an increase of 10,577 frs. (£423) during the twelve months. The next business was the appointment of nine members of the Committee to replace those retiring or deceased. The result of the ballot was the election of MM. Coindet, Vautier, De Lachomette, Des Gouttes, Gardiner, Piaton, Lenoir, Frère, and Séguin—the first five for three years, M. Piaton for two years, and the last three for one year. This completed the general business at the morning sitting. The Committee afterwards held a meeting for the election of officers for the ensuing year. The following was the result: *President*, M. Paul Mallet (re-elected); *Vice-President*, M. de Lachomette; *Secretaries*, MM. Delahaye and Visinet; *Treasurer*, M. Deleury.

On the resumption of the proceedings in the afternoon, the President delivered his Inaugural Address, which was summarized in the JOURNAL for the 27th ult., and a full abstract translation of which is given below. The remainder of the general business consisted of the presentation of the reports on the papers submitted in competition, on the premiums awarded for papers read at the last meeting, and on the donations to meritorious workmen. Two *mémoires* were sent in—one on the extraction of cyanogen from gas liquor; and the other on the present position of the gas industry, in view of the competition of electricity and petroleum—to compete for prizes. In their comments on the former paper, the Committee remarked that there is nothing new in the extraction of the cyanogen contained in ammoniacal liquor in the form of sulpho-cyanides. In England a process has been adopted for the purpose which has many points in common with that proposed by the author. As to whether or not the latter is preferable to the former, the Committee were not in a position to determine; and consequently, as in previous similar cases, they thought the communication could not be accepted in competition for a prize until the processes therein dealt with had been tested either experimentally or in practice. They therefore advised the author to submit his *mémoire* as an ordinary communication. The writer of the other paper reproduced, but without drawing any fresh conclusions therefrom, all that is known on the subject of lighting by gas, electricity, and petroleum. He compared, with more

or less accuracy, the cost of the three modes of illumination; and then described the means to be employed to increase the consumption of gas. These means, the Committee pointed out, had been adopted by a number of gas companies, and were already well known; having been made the subject of papers and discussions at previous congresses of the Society. Consequently, there was nothing new or particularly interesting in the *mémoire;* and therefore the Committee, while fully recognizing the efforts and intentions of the author, for which they thanked him, could not award him a prize. Nor did they think the communication worthy of being included in the Transactions, owing to the errors it contained in the comparison of the prices of the various systems of lighting. The next business was to award to Dr. Auer von Welsbach a gold medal for his incandescent gas-burner. The Committee expressed the opinion that the Auer burner would greatly assist gas companies in their competition with electricity, inasmuch as it utilized their product to the best advantage. A telegram was read from Dr. Auer von Welsbach, thanking the Society for the mark of distinction they had been pleased to confer upon him. The next matter to occupy the attention of the meeting was the presentation of the premiums for the best of last year's papers, of which there were twelve in all, with the addition of one sent as a competing *mémoire*, and, with the author's consent, taken as an ordinary communication. The Committee awarded three prizes of 250 frs. each—one to Mr. Chauveau, for his paper on "Gas as a Motive Power;" another to M. Lauras, for his description of a new regenerator furnace in use at the Rouen Gas-Works; and the third to M. Marchal, for his ingenious application of the Brouardel pressure-gauge to a number of useful purposes. The Committee expressed their high appreciation of M. Delahaye's paper giving statistics of gas and electric lighting in Massachusetts, which, as it was the work of a committeeman, could not be premiated. This being the case, they were the more grateful to those of their colleagues on the Committee who were good enough to send in papers. Next came the awards to meritorious workmen. There were 43 applicants for the prize of 200 francs each; and the Committee recognized the claims of 19. The ages of the candidates ranged from 46 to 82 years; and their periods of service in connection with gas-works, from 30 to 58 years. One of the awards this year was bestowed on a lady—Madame Verge—who had seen some thirty years' service in the public lighting department at the Barcelona Gas-Works. She is described as a thoroughly upright and devoted servant; and she distinguished herself during the epidemic of yellow fever in 1890.

On the morning of the second day of the meeting, the reading of papers was commenced. There were 23 on the programme; and they will be noticed in subsequent issues of the JOURNAL. The afternoon was devoted to visits—one being to Say's refinery, to inspect the installation of boilers, and the other to the works of the Compressed Air Company. In the evening the usual subscription banquet took place at the Hôtel Continental. On the resumption of the proceedings on the morning of the third day, the remainder of the papers were disposed of. In the afternoon, the members inspected the electric lighting works supplying the Champs Elysées quarter of Paris, and the new water reservoirs at Montretout (St. Cloud). These visits brought the meeting to a close.

PRESIDENT'S ADDRESS.

The President commenced by saying that when his predecessor and friend M. Melon stated, before the Quinquennial Commission of 1890, that the improvements introduced into gas-works for some time past had been of an economical order, he expressed an opinion which could not be discussed on the score of soundness, and the perfect justice of which had been confirmed by facts. In truth, for some years gas managers had all been preoccupied with the commercial interests of their industry, and had displayed in their development a zeal which would probably have appeared extravagant and out of place to their predecessors. He therefore asked permission to follow their example, and to discourse upon commercial affairs. He did not propose to deal with the various projects for increasing the consumption of gas which had been brought before the members, but simply to examine the commercial situation, present and future, of the residual products, and endeavour to discover any means of contributing to its amelioration. He then went on to refer to the close connection existing between the improvement of two of the residuals—tar and ammonia—and the development of the metallurgic coke industry; this industry, under the circumstances in which it is now carried on, being capable of furnishing materials almost identical with those obtained in the manufacture of gas, and, owing to the quantity procurable, of overburdening the market with them. Having briefly described the Knab and Carvès coke-ovens, the President proceeded to show that the yield of ammonia with these appliances depends mainly upon the nature of the coal distilled. With certain German coals, as much as 11·5 kilos. of sulphate per ton is sometimes obtained. He pointed out that, in this industry, no great attention has to be given to the illuminating power of the resulting gas, which can be very freely washed with water, or even with sulphuric acid. It is therefore easy to arrest the last traces of ammonia It is also possible to rob it of its most condensable hydrocarbons. The quantity extracted varies from about 1 to 4 kilos. per ton of coal, according to its character. The products obtained are also of variable composition, boiling between 80° and 180° C., and containing, on an average, from 40 to 50 per cent. of crystallizable benzene. Passing on to present some statistics connected with the coke industry, the President stated that, although residuals furnaces were first thought of and studied in France, they had not developed there to any extent—the number in use being only 210, as compared with 413 in England, and upwards of 1250 in Germany; and he went on to ask what quantities of bye-products would be obtained if all the coal destined for the manufacture of metallurgic coke were carbonized in closed ovens. In France, according to M. Jordan, there is actually produced about 1,500,000 French tons of metallurgic coke resulting from the carbonization of 2,000,000 tons of coal. Assuming yields of 9 kilos. of sulphate, 22 kilos. of tar, and 1·5 kilos. of light oils per ton, these 2,000,000 tons would be capable of furnishing 18,000 tons of sulphate of ammonia, 44,000 tons of tar, and 3000 tons of light oils. In Germany, there were in 1891 altogether 15,700 furnaces in operation, producing 7,700,000 tons of coke. These would be capable of yielding, if they worked with condensation, 110,000 tons of sulphate of ammonia, 375,000 tons of tar, and from 10,000 to 30,000 tons of light oils. These quantities, as M. Mallet remarked, are considerable—equalling, and even in some cases surpassing, those produced in the gas industry.

The President then proceeded to deal at some length with the three principal residual products of gas manufacture—tar, ammoniacal liquor, and coke. In connection with the first, he stated that tar will always have a low value in proportion to that of the other combustibles. It could be made of more worth, if they could succeed in having it readily employed in the industries in which very high temperatures are used. For the production of these, gaseous or liquid fuels, composed exclusively of carbon and hydrogen, possess a value superior to that of their calorific equivalent. Beyond its employment as an eventually precious combustible, tar has by nature only insignificant uses; and it derives its value from its secondary products, the most important whereof are benzol, anthracene, pitch, heavy oils, and essences for dissolution. The compressed fuel industry, which once constituted for pitch a market so safe that fears were entertained lest the supply should fail, is no longer developing. It is not because the quantity of slack, and especially of poor slack, from the mines is falling off, but because endeavours are continually being made, and with success, to utilize it on the spot. The railway companies, who were large consumers of fuel briquettes, are gradually managing to do without them. In 1883, the railways consumed altogether 2,798,379 tons of fuel, of which 1,611,292 tons consisted of briquettes; being 57 per cent. of the total. In 1890, the consumption of briquettes was 1,053,577 tons out of a total of 3,280,175 tons; being 32 per cent., or a diminution of 25 per cent. Nearly all the other industries have employed small coal in various forms of furnaces. The result has been that slack, hitherto neglected, has been more and more sought after. Its price has consequently risen progressively; and the owners of mines have found it less advantageous to convert it into compressed fuel. For a very long time people failed to recognize the antiseptic properties of the heavy coal oils, and their value for the preservation of wood. The administration of the Belgian State Railway and that of the Ponts et Chausées of the Netherlands were the first to apply these oils for the preservation of sleepers and wood piling. The French railway companies continued to use sulphate of copper until about 1865; but since that date they have employed heavy coal oil, with the exception of the Eastern Railway, on which chloride of zinc is still used. This process, however, is not destined to become general, inasmuch as the results obtained therewith are very inferior to those produced by creosoting; and, moreover, it is likely to be more costly. As the quantity of wood employed augments fairly rapidly, owing to the extension of railways and the placing of the sleepers closer together, we may consider that injection furnishes certain employment for heavy oils; but we must not lose sight of the fact that great efforts are being made to substitute metal sleepers for wooden ones. The former have already been employed in large numbers in Europe; and the defects which have been very justly alleged against them will no doubt be remedied. If they should eventually supplant wooden sleepers, the heavy oils would once more be utilized merely for heating purposes, and their market value would consequently decrease. The manufacture of colours opened out about thirty years ago, the most brilliant prospects for coal-tar products. Benzols, which were at first solely employed in their manufacture, and which have remained the principal element, have now attained very great value. This, however, has fallen off of late years; and the same may be said with respect to anthracene. From 1872 to 1886, the price of benzol in Paris fluctuated between 100 and 300 frs. per 100 kilos. Since the latter year, it has ranged from 100 frs. down to 45 frs. From 1872 to 1882 the price of anthracene varied from 6 frs. to 13 frs. per kilogramme; but more recently the average price has been 3 frs. During the same period, benzene has gradually fallen from 129 frs. to 50 frs. per 100 kilos. It is probable that people will turn their attention for a long time yet to the derivatives of coal tar for the production of the colours now in use; and possibly others will be extracted from them. It is equally possible

that fresh uses will be found for these bodies, seeing that quite recently picric acid has been employed in the manufacture of explosives. But it would be a bold thing to assert this, as it would have been bold 35 years ago to have stated that madder and archil would be constantly employed. At all events, it is probable that high rates, especially for benzols, will no longer be the rule. He, therefore, who is desirous of acting prudently should reckon that the prices of the principal derivatives of coal tar will tend towards lower averages than the last few years, and that tar will necessarily follow.

Taking next the subject of ammonia, the President indicated successively the forms in which it is consumed in large quantities—viz., caustic ammonia, hydrochlorate of ammonia, nitrate of ammonia, concentrated liquor, and sulphate of ammonia. He pointed out that the first, which was once in very considerable demand, has lost a great deal of its importance. A few new outlets have been created for it, such as the manufacture of artificial ice; but the employment of ammonia for refrigerating purposes is too small to constitute this an outlet. The consumption of hydrochlorate of ammonia had, he said, been greater since the invention of the Leclanché battery; but it would diminish very considerably if a more preferable appliance for telegraphic or telephonic purposes were discovered. With regard to nitrate of ammonia, it occupied merely a small place in the industries, in connection with the manufacture of explosives; and concentrated liquor was used in the ammonia-soda process, which had developed considerably of late, and would do so still more. However, it was not, and never would be, a consumer of the first order. Coming to the more important form of ammonia for gas makers—the sulphate—the President said that some 35 years ago, sulphate of ammonia was scarcely employed as a manure in France, and French producers were only just beginning to sell it to English agriculturists. As soon as its advantages came to be recognized, however (which was not unattended with difficulty), the product was very keenly sought after. From 1868, instead of being exporters, Frenchmen became importers; and the price of sulphate rose rapidly from 28 to 50 frs. per 100 kilos.—a rate which was kept up almost till 1882. It was probable that it would have been continued, and even exceeded, if agriculture had not found in nitrate of soda a new source of nitrogen, which almost immediately caused the price of sulphate to fall to 30 frs. Pure nitrate of soda contained 16·47 per cent. of nitrogen; sulphate of ammonia, 21·21 per cent. It was therefore a manure very rich in nitrogen. In certain cases nitrate was inferior to sulphate; in others, superior. On the whole, they were equal. The annual exportation of nitrate had risen progressively from 16,500 tons in 1836 to 200,000 tons in 1872, when it began to be employed in European agriculture. The output then progressed rapidly. It became equal to 285,000 tons in 1873, 325,000 tons in 1875, 430,000 tons in 1885, and 932,000 tons in 1889; this notwithstanding the fact that Chili, which by right of conquest appropriated the nitrate grounds, had since 1880 imposed on nitrate an export duty of 6 frs. 24 c. per 100 kilos. This high duty had not only not checked the rapid increase of consumption, but had failed to stop the fall in the selling price, which, having fluctuated between 29 frs. 50 c. and 44 frs. 50 c. per 100 kilos. on railway trucks at Dunkerque from 1867 to 1879, fell gradually to 19 frs. 60 c. in 1889. A few years since, the quantities exported were distributed among the various countries of the world as follows: Germany, 35 per cent.; France, 26 per cent.; Belgium, 12 per cent.; England, 12 per cent.; the Netherlands, 12 per cent.; United States, 8 per cent.; and other countries, 3 per cent. According to M. Legrand (to whom the President acknowledged his indebtedness for the greater part of the information he possessed on this question), Belgium consumes in proportion to its territorial surface, six times more nitrate than Germany, nine times more than France, and eleven times more than England; and it was estimated that Belgium, Germany, France, and England only consumed respectively, 1-6th, 1-36th, 1-54th, and 1-66th of the quantity they could profitably employ. Should the progress of agriculture bring about such a consumption in the countries above indicated as would amount to more than 30,000,000 tons a year, the other countries within and outside Europe would equally become consumers; and the total requirements would reach a very high figure. Would agriculture ever develop such demands? Nothing was less certain. But if it should approach it, even distantly, it would be but very progressively. The exportation took forty years to multiply tenfold; it might therefore be reckoned that for a long time to come it would be less than 10,000,000 tons. This would be equal to an average of 6,000,000 tons spread over a long period; and as the nitrate deposits were estimated at 250,000,000 tons, it would require forty years to exhaust them. The scarcity of nitrate could not, therefore, be reckoned upon for raising its price; and while it remained cheap, sulphate would be cheap also. Of the latter, England produced only 75,000 tons in 1883; whereas last year the quantity was 157,000 tons. If all the bye-products in the United Kingdom were recovered, there would be a gigantic increase in the production of sulphate. Looking at the above figures in connection with the quantity of sulphate of ammonia which the Germans are capable of manufacturing, and bearing in mind the fact that Austro-Hungary, Russia, Spain, and the United States might become producers, the enormous quantity of ammonia which could be put upon the market might be estimated. Allowing for all the surprises which the chemical industries have in store, it might safely be asserted that none of them would be capable of absorbing all the ammonia that could be produced.

Passing on to the subject of coke, M. Mallet emphasized the importance of gas managers studying the means of turning this residual to the best account. He pointed out that thirty years ago it would have been impossible to dispose of the quantities of coke now produced in gas manufacture. At that time, especially in the provinces, consumers did not know how to burn it for domestic purposes; whereas now they have become accustomed to it, chiefly because it has been offered to them in a suitable form, and because proper appliances for using it have been placed at their disposal. The Paris Gas Company have done much towards attaining this object; they being the first to devise and distribute special appliances. The Marseilles Gas Company also, who have from the commencement used coke in their metallurgical establishments, pass at the present time 10,000 tons a year through their furnaces at St. Louis; being about 40 per cent. of the total make. In the department of the Loire, certain blast-furnaces consume coke in the proportion of 30 per cent. of the total fuel. Several railway companies have substituted gas coke for oven coke on their locomotives running in the outskirts of towns. The four important railway companies having their termini in Paris burn in this way from 75,000 to 80,000 tons a year. Large metal foundries employ it in their generator furnaces; numerous establishments have adopted it for their forge fires; and beyond these special uses, where it is sought after for its own particular qualities, it may now without much trouble find an outlet among a number of industries for heating, at least partially, most of their steam generators, at a price equal to coal. While gas companies formerly found it difficult to dispose of their coke, they made little or nothing out of their breeze. Now, however, it is burned in grate and generator furnaces. Thanks to the introduction of step-grates on Godillot's system, and stage and air-blast furnaces on those of Perret and Robin, manufacturers now utilize it either alone or mixed with good slack. Something like 500 fire-grates on the stage principle have been put up by M. Robin in Paris alone for warming public and private buildings; and 1400 in the provinces and abroad. Even in certain installations for generating steam, where the surfaces of the fire-bars have been increased in area, the spaces between them being reduced, a mixture containing as much as 70 per cent. of breeze has been burnt without forced draught. In Say's refinery, there is an installation of 60 boilers, having a total heating surface of 15,440 square metres, at work under the foregoing conditions. These applications lead to the conclusion, without being optimistic, that breeze will be saleable everywhere before very long, and at acceptable prices. Here, continued the President, is a collection of facts which, it cannot be denied, are very favourable: but there are others which have an opposite significance. The portable stoves which have helped to develop the consumption of coke have excited the rivalry of anthracite, which previously had only been employed in a small number of industries; and this fuel, as well as other similar hard coal, is being burnt not only in moveable stoves, but in nearly all fires which were formerly exclusively fed with coke. Fortunately, real anthracites, such as the Welsh, Norwegian, and Russian, which contain from 5 to 7 per cent. of volatile matter and from 2 to 2·5 per cent. of ash, are dear. They cost in Paris, without *octroi* dues, about 50 frs. per ton. Certain merchants, in order to sell it cheaper, have attempted to mix it with hard coal containing from 12 to 15 per cent. of volatile matter; but these mixtures produce bad results, and would bring anthracite into discredit if the practice continued. Notwithstanding this, it is a troublesome rival.

Discoursing further on this topic, M. Mallet said: The most serious adversary to an increase in the price of coke is ourselves, by the earnestness we display in extending the consumption of gas. It would be advisable, therefore, in making our calculations, when we are led to grant reductions in the price of gas, not to place the value of coke at the price some of us obtain now, but at a figure approaching more to that of coal. It is to be feared that the increasing abundance of this combustible will bring about some day a commercial situation similar to that which it has created in the United Kingdom. Statistics prove already that the Paris Gas Company deliver for industrial purposes more than 50 per cent. of the coke produced in their works. I am persuaded that we can retard and diminish the importance of this situation, so inimical to our interests, by sustained and judicious efforts which would augment the domestic consumption. Indeed, in most villages, the employment of coke is unknown. In many towns lighted by gas, even in the North and East of France, the consumption per inhabitant scarcely reaches one hectolitre (2·75 bushels); while in others, where the climate is not so cold, it is more. At Beauvais it is 3·5 hectolitres; at Rouen, 5 hectolitres. There is nothing to prevent the sale of coke in villages which are not near woods; neither is there any reason why a consumption equal to that of the western, is not reached in the northern half of France. In fact, certain of our colleagues consider this may even be exceeded. It must not be said that in this or that part of the country coke cannot contend successfully against the low price of coal, and the old-established custom of the population in employing it. The example of Brussels,

among others, proves that these considerations are incorrect, and deprived of their force. In 1885, the consumption in Brussels was 0·86 hectolitre of coke per head of the population; whereas in 1891 it was 2·58 hectolitres.

If increases in consumption are possible, what means should we employ in order to bring them about? In places where the consumption per head of the population is small, and where coal and anthracite show high returns, it would be wise to modify, at least for a time, the selling price on the spot. This would be, in most instances, an efficacious mode of making known the employment of coke to all consumers, in order to induce them to use it permanently, and to familiarize them with its advantages. This would not always mean a loss, even a temporary one, as it will often be found that it is less disadvantageous to dispose of all the production to local customers on rather reduced terms, than to sell only a portion at a high rate, and get rid of the remainder at a loss, in favour of the brokers and the railways. In any case, it would be a process more generally favourable to the gas industry. It is now admitted that, in order to sell coke to domestic customers, it must be broken. It should therefore be superfluous to urge the advantages of selling it in this form; yet we still meet, not without astonishment, some of our colleagues who do not adopt the practice. Those who have the management of large works are inexcusable; but even in small works recourse must be had to breaking, at least on a scale suitable to a small business. Slow-combustion stoves require dry fuel, as moisture rapidly deteriorates them. Is it, then, necessary to say that it is our duty to store our coke under cover, and to make known that we keep it in stock at the disposal of those who may require it? In districts where coal and wood hold positions from which it is difficult to dislodge them, it is often because specially suitable appliances for the combustion of coke are little known or employed. Our Belgian friends, under the pressure of large stocks with which they are loaded, and which they can only get rid of at very low prices in spite of their efforts, are endeavouring to improve the apparatus for heating by coke. With this view, they have instituted a stove competition which will probably produce some interesting results; and our industry should be thankful to them for it. But, such as they are, the apparatus we already possess are sufficient, and capable of attaining the object we aim at, provided they are judiciously chosen, well distributed, and sold. For distributing them, and making their advantages known, we should not hesitate to advertise them in every way, and place them in exhibitions. In order to sell them, we must resolve to adopt the methods we have employed with success for some years past to increase the consumption of gas. Why should we not, following the example of those firms who sell on the hire system, and so capture customers of small means, consent, where necessary, to give credit to those who buy coke heating apparatus from us? Domestic customers are evidently those which should be sought after most energetically, because it is they who bring us most profits. But wherever there is a considerable make of coke, and its domestic employment is not sufficiently developed, also where there is very serious competition against it, we are compelled, in order to ensure an outlet for our production, to endeavour to sell it to manufacturers.

Dealing next with the uses of coke, the President remarked that they are of two kinds—*i.e.*, those where fuel containing volatile matter cannot be employed, such as in blast-furnaces and foundries, and by lime and cement makers working by the ordinary processes; and those where coke is burnt as an ordinary fuel. Under the first head, it can, and should, command a higher price than coal equal in heat-producing power; but it is not so as regards the second. Yet in numerous cases—such as when it is required to localize the temperature, to specially employ radiant heat, or to burn a very large quantity of fuel per unit of grate surface—coke has special qualities which may influence an increase in price. Gas-works are generally badly situated for the placing of coke amongst manufacturing customers, and for selling it to them under the best conditions. Beyond their own immediate neighbourhoods, they have no commercial relations; they are ignorant of the requirements, and are often unfitted to discuss the means of meeting them. Thus, from a purely commercial as well as a technical point of view, it would be advantageous, and even necessary, that we should unite our interests, and entrust our outside sales to a few thoroughly competent agents under one management. There are numerous and successful precedents in favour of such a measure; and it would be productive of excellent results. It would put an end to those detestable methods with which my predecessor found fault last year, and which the facts only too clearly proved.

Passing on to consider another branch of the question, M. Mallet reminded his audience that, in order to gain the custom, at least partial, of the blast-furnaces, which now more than ever absolutely require hard coke, some gas managers prolong their distillation up to six and even eight hours. But why, he asked, should they stop at this limit? Why not extend it to that which would produce metallurgic coke without the employment of special ovens? The idea is not new; it was applied more than thirty years ago by the Paris Gas Company in their works at Ivry and La Villette. But, since then, coke-ovens have been so improved as to affect the results then obtained. Carbonization is effected in much less time, and at a higher temperature; and the composition of all the volatile products, especially gas, is greatly changed. If, notwithstanding these advantageous improvements, the carbonization of certain coal produced gas of insufficient illuminating power, it would not be impossible to improve it. It would be easy, in fact, in the case of such a large apparatus as a coke-oven which deals with as much as 4 tons per 24 hours, to fit up an arrangement for classifying the products of distillation. With regard to comparatively poor gas, several uses can be found for it. If there is a considerable output of coke, the inferior gas could be burnt under the ovens. In other cases, it could be enriched, as it will be necessary to enrich water gas, if this ever definitely crosses the Atlantic. Again, it might be worth while to distribute it by special conduits for heating purposes or for lighting by incandescence. Technically, the manufacture of coke in ovens does not present insuperable difficulties; and there would be the advantage of simplifying the processes of charging and drawing. But, from a practical point of view, it is not altogether the same; and the following drawbacks would arise. Many gas-works are situated too far from the localities for the consumption of metallurgic coke to allow it to be manufactured with advantage. From the very nature of the installations they necessitate, coke-ovens do not lend themselves to a small production. As the industrial requirements are approximately constant, large quantities of coke would have to be stored up in winter, or else only the corresponding number of ovens needed for the summer supply of gas would have to be worked. Lastly, large superficial areas are essential for establishing coke-ovens; and it is not all gas-works which have such areas at command. However, for those which carbonize upwards of 15,000 tons of coal per annum, and are favourably situated, this solution may present a certain interest, and enforce our attention to it. But I hear this objection: Do you not take water gas into account? Do not the results it has produced in the United States justify us in considering it as capable of solving the coke question? Far be it from me to fail to recognize the interest presented by this important modification of our industry. But, while giving very serious attention to the trials which have been made in Europe, and basing a certain amount of hope thereon, we should not overlook a number of weak points which they entail. First of all, it cannot be too often repeated that in this respect we are in a quite different position from that of the Americans. Anthracite is very abundant with them, gas coal is comparatively rare, and carburetting products are very cheap. With us it is almost the reverse. Thus that which is advantageous on one side, may not be so on the other. Then, would the public authorities in France lend themselves to the substitution of water gas for coal gas? You are sufficiently acquainted with their tendencies and their ways of acting not to risk an affirmative reply. Finally, while admitting that the manufacture of water gas is of advantage from a commercial point of view, and that the authorities accord their permission, what price would they give for coke? It would certainly be a very low one, and would approximate to that which we now quote to the manufacturing industries.

In bringing his address to a close, the President said: Gentlemen, if you think we may be permitted to draw deductions from such a rapid study as we have just made, the following are those I would propose to formulate:

(1) Although, in the matter of chemical products, we may expect surprises in opposite directions, we should anticipate, with regard to tar and ammoniacal products, lower average prices at the present time than those prevailing in the past.

(2) Concerning coke, favourable hopes are still less permissible.

(3) In order to check this movement as far as possible, we should make much greater efforts than we have done in the past, and especially employ less primitive commercial methods. We should particularly permeate ourselves with the motto of our neighbours: "Union is strength."

(4) Those who still claim that we have in our bye-products alone elements capable of keeping our industry alive, either continue in ignorance, and more deeply than ever, in regard to it, or refuse to study the conditions of its existence.

SOCIETY OF CHEMICAL INDUSTRY.

Annual Meeting in Liverpool.

This Meeting was held on Wednesday, Thursday, and Friday of last week, under the presidency of Sir John Evans, K.C.B., F.R.S. The business was transacted in the theatre of University College, Liverpool, in the presence of about 150 members and friends.

After a hearty reception of the Society to Liverpool by the Lord Mayor (Mr. R. D. Holt) and by Dr. Campbell Brown on behalf of the Senate of University College, the report of the Council was presented. It stated that the number of members on the register was 2785, as compared with 2782 at the last annual meeting. During the year 208 new members had been elected; and 206 had been removed by death, resignation, and other causes. Among those who had died were Dr. Longstaff,

the veteran chemist, Mr. Norman Tate, who was one of the Vice-Presidents, and Professor William Foster, of the Middlesex Hospital—"a well-known authority upon coal gas." During the past session 74 original papers had appeared in the Society's *Journal*—precisely the same as last year. The excess of revenue over expenditure amounted last year to £590 12s. 4d., as against £536 13s. 8d. in 1891. In February last, in response to a general expression of opinion that the patent laws of the country stood in need of revision, a Committee was formed to consider the whole subject of the patent laws. Several meetings of the Committee had been held; and it was in contemplation to lay before the Sections during the autumn a series of questions embodying the objections which had been raised. Should their deliberations lead to agreement as to the course to be pursued, the Council proposed, if possible, in conjunction with other public bodies, to petition the Government for the appointment of a Royal Commission. The report was received and adopted; and the Treasurer's financial statement was also approved.

The President then delivered his address, in the course of which he said that he firmly believed that only by cordial co-operation among the different industries of this country, such as that which their Society had inaugurated, was the commercial position of Great or Greater Britain to be maintained; and the more fully the interdependence between one branch of manufacture and another was recognized, and acted upon, the more likely were Englishmen, as a whole, to maintain their place in the keen race of competition with other countries. A merely cursory glance at their *Journal* would at once show how numerous were the departments of British industry that were more or less dependent on chemical knowledge; the information given on current literature and the specifications of new patents being arranged under no less than three-and-twenty different heads—many of them embracing several varying occupations. Not a few of these headings would, within his memory, have conveyed but little meaning even to experts. He need merely carry back the minds of some of the elder members of the Society, not only to the days when aniline colours were not, and Dr. Perkin was comparatively unknown, but to the time when lucifer matches had not been invented, when photography was practically non-existent, and when in most of those industries in which a knowledge of chemistry was now regarded as indispensable, "rule of thumb" reigned absolute. Having referred, as an instance, to the improvements effected in the manufacture of paper, he said that these had been paralleled in numerous other departments of commercial enterprise, and not the least in those connected with the manufacture of chemical products themselves, in many, if not, indeed, in most of which a complete revolution had been effected within the last fifty years, or even less.

Chemistry some fifty years ago was not by any means in its infancy. Its foundations had been securely laid not only on the Continent, but in this country; and the names of Priestley, Cavendish, Schoole, Lavoisier, Davy, Wollaston, and other English investigators were already household words. There were, in 1841, twelve simple non-metallic substances known, and forty-three metals. The atomic weights of various substances had been approximately determined, though modern investigations had in some instances materially changed their ratio. Though hydrogen had retained its place as the unit, oxygen was no longer represented by 8, but by 15·96, or even less. Sulphur that was then 16 is now 31·98. Selenium, instead of 40, has now 78 assigned to it; while the number for tellurium had been increased fourfold—from 32 to 128, and phosphorus had gone up from 16 to 30·96. Whether all our present figures would stand the test of time, remained to be seen; and, indeed, recent researches had shown cause to doubt the accuracy of some of the figures quoted. For himself, as a somewhat profane outsider, he must confess that it would be a source of satisfaction if future investigations should show that the figures now having three or four places of decimals attached to them, might more properly be converted into integers, and oxygen come out boldly as 16 and sulphur as 32.

Turning to the simple substances and metals, of which 12 and 43 were known in 1841, they found them now slightly increased. Of non-metals they reckoned 15; and of metals, 48. On the whole, the changes and advances in inorganic chemistry had not been extreme. It was in organic chemistry that what cannot be regarded as anything short of a revolution had taken place. But whatever might have been the advances made in chemistry within the last fifty years, whether as a pure or as an applied science, the extension of its boundaries towards physics in the one direction and biological studies in the other, was at least remarkable. While the study of spectrum analysis had rendered most valuable assistance in the chemistry of the constituent substances with which they were familiar upon earth, it had enabled the astronomer to carry his speculations not only to the constitution of the sun and stars, but to that of nebulæ, comets, and meteors; and, in the hands of Mr. Norman Lockyer and Mr. Huggins, it might yet lead us to travel with some degree of confidence in paths hitherto untrodden. In the domain of electricity it is hard to say whether that science does not owe nearly as much to chemistry as chemistry does to it. The study of heat, irrespective of electricity, had largely reacted on chemistry; and while the Bessemer process had entirely revolutionized the manufacture of steel, and almost annihilated the distinction in value between that and other forms of iron, the Siemens and other furnaces had led to unprecedented economies in the expenditure of fuel, and at the same time had facilitated the application of heat in various chemical processes. In the other direction—the absence of heat—Professor Dewar had during the present year made most important advances. Although air had previously been liquefied, he had now been able, by means of intense cold alone, to reduce the atmospheric air to the liquid condition. His further results, by a combination of enormous pressure and extreme cold, were well known; and now that oxygen and nitrogen had yielded themselves to the advances of science, and had been obtained in quantities in a liquid state, it was hard to say that hydrogen was destined always to remain intractable. What might be the ultimate result of the investigations that can now be carried on at temperatures ranging from 100° to 200° below the freezing point of water, it was impossible to foresee. From researches already made in this country and in France, it would appear that most substances under extreme cold are, so to speak, dead; and that their ordinary affinities are in abeyance.

As to the advances in knowledge of the chemistry of light, the present condition of photography might testify. When one could take images of a bullet flying at the rate of 3000 feet per second, with its accompanying cone of compressed air; produce photographs which were practically permanent; and call in the action of light to engrave steel or copper plates, and to produce efficient substitutes for wood-cuts—they seemed to be getting near the limits of the practical application of photography. In the introduction of artificial light much also has been done. Gas had now to compete with electricity as an illuminant; while, in many cases, it had been superseded by mineral oils, which were now so abundant and cheap, and of which in their Society the flashing point might be said to be almost a burning question. If, however, gas was losing ground as an illuminant, it seemed to be gaining it as a source of power; and there were prospects of a considerable increase in the use for this purpose of hydrogen and its compounds, containing far less carbon than ordinary coal gas. In metallurgy also, in addition to the improvements in the manufacture of steel, many noteworthy discoveries had been made. One of the most important of these was perhaps that of the production of aluminium on a cheap scale, and in quantities sufficient for various applications to ordinary use.

After alluding to other similar advances in different branches of science, the President continued: Now that so many diseases have been traced to pathogenic organisms which are constantly present in water contaminated by sewage, the question of the vitality of these organisms and their germs has been rightly regarded as one of great public importance. The remarkable power of light (whether that of the sun or electric) in sterilizing the germs of some micro-organisms, already to some extent previously known, had been conclusively demonstrated by Professor Marshall Ward. Much had been done of late years by chemists towards the purification of sewage, with a view of rendering the effluents from the ultimate drains of our large towns as innocuous as possible; and the results obtained have been in many instances satisfactory. They would, no doubt, have been even more so had not the imperative demands of economy limited the cost. He would not attempt to discuss the important question of the disposal of sewage of great towns; but to many it would appear as somewhat of a disgrace to their powers of applying chemical knowledge, that such vast accumulations of what were originally highly fertilizing substances should be discharged into the estuary of the Thames, and not only be absolutely wasted, but become a perpetual nuisance, brought up at each tide within the limits of the Metropolis from which they started. Within the last fifty years we have imported enormous quantities of guano, phosphates, and nitrates; but of these there must eventually become a scarcity, if not an end. In the meantime, might not chemists do something to reduce the waste of fertilizing agents that was now taking place among us? Agricultural colleges had been founded—agricultural chemistry was a recognized branch of science. But with increase of knowledge had come increase of foreign competition, fostered by improved means of transport and communication; and it was at the present time a doubtful point whether many soils, even if rent-free, could be cultivated in this country for cereals, except at a loss.

Concluding, the President said that they were assembled on the borders of the two counties of Lancashire and Cheshire, in both of which were great centres of chemical manufactures, and the principal productions of which were in a great degree dependent upon the knowledge and due application of chemical laws. They met at the seat of one of the most active Sections of the Society of Chemical Industry, which had received them with open arms, and had provided them with an "Open Sesame" which would admit them to inspect many of the most interesting of the works and factories of the district. They gladly availed themselves of these opportunities; and if by chance any of them could afford assistance, advice, or encouragement to their brethren in Liverpool, he was sure that all present would gladly render it, and not forget that they were all members of one body, and all mutually interested in the advance of chemical knowledge, and especially of chemical industry.

After a vote of thanks had been passed to the President for his address, the result of the balloting for the Council for the next year was announced. Mr. E. C. C. Stanford, of Glasgow, was

declared elected President; the Vice-Presidents being: Sir F. Abel, Bart., Sir John Evans, K.C.B., Sir John Turney, Professor Reynolds, Professor T. E. Thorpe, Dr. F. Hunter, Dr. W. H. Perkin, Messrs. W. Crowder, John Spiller, H. Brunner, H. T. Brown, and E. K. Muspratt. Mr. E. Rider Cook was elected the Society's representative on the governing body of the Imperial Institute. The next annual meeting is to be held in Edinburgh.

The members afterwards inspected the Victoria Buildings, the Walker Engineering Laboratories, the Chemical Laboratories, the old buildings, and the new Royal Infirmary. In the evening a conversazione and reception took place in the Walker Art Gallery, when the guests were received by Mr. Henry Brunner (the Chairman of the Liverpool Section of the Society) and Mrs. Brunner. Thursday and Friday were devoted to visiting various works, &c., in the locality—among others the United Alkali Company at Widnes; Messrs. Laird's shipbuilding yard; Messrs. Cope Bros'. tobacco factory; the Lancashire Watch Company's works at Prescot; the Liverpool Overhead Railway; the Alexandra Dock Grain Warehouses; and the Cunard steamer *Campania*.

THE HARROGATE WATER-WORKS.

The members of the Yorkshire Section of the Association of Municipal and County Engineers recently had their annual meeting at Harrogate under the presidency of Mr. J. CARTWRIGHT. Two papers were read on the occasion—one on "Municipal Work in Harrogate," by the Borough Surveyor (Mr. S. Stead); the other on "The Water Supply of Harrogate," by the Water Company's Engineer (Mr. E. W. Dixon). We take from the latter communication the following particulars.

Apart from the medicinal springs for which Harrogate is famous, the town is furnished by a private Company, with a supply of water obtained by gravitation from the moorlands situated a few miles to the west of the town. The first step towards providing a supply was the obtaining of an Act of Parliament by the Company in 1846; several small springs being utilized, and the water stored in three open reservoirs, now known as the Irongate Bridge reservoirs for further distribution. Owing to the then scanty population of the district, these early works were necessarily projected on a very limited scale. After fifteen years, the number of consumers only reached 336. About 1861, with the introduction of an improved railway system through the neighbourhood, the demand for an increased supply became more urgent. With a rapidly increasing population, more extended and reliable works became necessary; and at the close of 1861 we find the Company acquiring powers to construct gravitation works for obtaining a more adequate supply. In 1868, a second Act of Parliament was obtained for extending the works; and with this date it may be said the first engineering works of any magnitude were commenced. From 1861 down to the present time, the growth of Harrogate has been at a rate considerably in excess of anything that could have been originally anticipated. From a mere village, deriving its supply of water from two or three small springs, it has developed into one of the most important watering-places; the present average population supplied being 24,000 persons, with a consumption equivalent to 230 million gallons per annum.

The first reservoir to be constructed in connection with the gravitation scheme was the "Ten Acres" reservoir, so called from its water area when full. This reservoir receives its supply from a drainage area of about 330 acres; and from the nature and cleanliness of the watershed, the quality of the water is excellent. Its maximum depth is 35 ft. 6 in., with a capacity of 36 million gallons; the top water-level being 610 feet above Ordnance datum, and more than 200 feet above the central portion of Harrogate. The formation of this reservoir was attended with considerable difficulties. To secure a satisfactory foundation for the main puddle wall, the excavations had to be carried to a depth of upwards of 40 feet on the north side of the valley. The north slopes are also further protected with sheet puddling. The puddle wall extends from the foundation of the trench to within 2 feet of the top of the embankment, with a maximum width of 12 feet at its base and at the seat of the bank, but reduced to 6 feet wide at top water-level. The main embankment extends due north and south, and is 700 feet long, with a central height of 42 feet; the batters being 2½ to 1 inside, and 2 to 1 outside. The supply is drawn through a single 12-inch cast-iron socket outlet main passing through the centre of the embankment. The reservoir is provided on the south side with a stream diversion, for passing away the flood waters when unfit for storeage. It has also a large sand filter-bed, which can be used for removing any suspended matter. By this means the water is kept in satisfactory order. The inside slopes are all protected with stone shingle; the back being pitched with coursed blocks 12 inches deep, set on 9 to 12 inches of shingle.

To work in connection with the reservoir above described, the Harlow Hill reservoir was constructed on the Otley Road, at an elevation of 545 feet above Ordnance datum. It contains 14 million gallons at a maximum depth of 19 feet, and is formed by half excavation and embankment, with slopes 2½ to 1 inside, and 2 to 1 outside; the entire slopes being protected with stone pitching. This reservoir is connected with the "Ten Acres" by 5800 yards of 9-inch and 7-inch cast-iron pipes; the daily supply being 200,000 to 300,000 gallons. The water here undergoes a further process of sand filtration, through 4ft. 6in. of sand and gravel; and it is finally passed into the highest districts of the supply—constituting the high-service supply.

In the year 1875, it was found necessary to obtain additional storeage; and the Beaver Dyke reservoir was projected, to operate in connection with the existing service reservoirs. This reservoir has an area of 23 acres, and at 43 feet deep contains nearly 120 million gallons. It receives the surface waters of 700 acres of moor and pasture land—an area which can be further increased whenever necessary. The top water-level is 559 feet above Ordnance datum, and consequently about 160 feet above the town of Harrogate. The early works at this reservoir comprised very little beyond earthwork; the bank having been raised from time to time as additional storeage was required. The raising of the embankment to its full height, the construction of a valve-tower, overflow weir, bridge, bye-wash, and other works, have been in progress during the past two years, and are now in an advanced stage towards completion. The embankment is 52 feet high at its centre, with a total length of 660 feet; the slopes being 3 to 1 inside, and 2 to 1 out. The inside is protected for 30 feet vertical depth with 18-inch rough stone pitching; the top portion being coursed block pitching 12 inches deep, set on 12 inches of shingle. The bank top is 12 feet wide, and is carried up 5 feet above the top water-level. It will be further defended by a dwarf wall running longitudinally along the whole length of the embankment. The overflow weir and bye-wash are situated at the north end of the embankment, and excavated in the natural ground. The valve-tower stands in the inside slope, 35 feet from the centre of the embankment, and contains two 12-inch sluice-valves for regulating the two discharge or outlet pipes passing under the main bank. It is circular, 53 feet deep, 7 feet inside diameter, and constructed in brickwork in cement, with 2 feet of puddle backing; it is also provided with a pitch and tar composition joint. The top portion of it, exposed to the water, is in rusticated ashlar masonry, set in cement. A 9-inch cast-iron main, 100 yards long, connects this reservoir with the Irongate Bridge service reservoirs, where the supply undergoes natural filtration through sand beds.

Two filter-beds are in operation at the Irongate reservoirs; but they form only part of the intended scheme of filtration. They are constructed entirely in Portland cement concrete, mixed in the following proportions: Four parts broken stone, two parts clean river sand, one part cement. Each bed has an area of about 430 superficial yards; being 64 feet long by 60 feet wide, and 6 ft. 6 in. in depth. The walls are 2 ft. 3 in. thick at the foundation, reduced to 18 inches under the coping; and they are entirely surrounded with 2 feet of clay puddle. The floors are formed by 12 inches of concrete, resting upon natural clay; the top surface being floated with 1 inch of cement composition. The main and cross channels are 15 inches wide, by from 6 to 9 inches deep, formed in the bottom, and covered with good flat stones, set 2 inches apart. Six 2-inch copper ventilating-pipes are provided to each bed, communicating with the main and cross channels. The water is delivered on to each bed by means of 10-inch and 7-inch cast-iron pipes, terminating in fountains fixed in the centre. The outlets and overflows are also in iron-piping, fitted with sluices and wash-outs for cleansing purposes. The filtering medium is composed of sand and gravel, 4 ft. 6 in. in thickness, placed in regular courses the following depths: 2 feet of fine sand, 6 inches of coarse sand, 6 inches of fine gravel, 6 inches of coarse gravel, and 1 foot of large stones. The water is allowed to stand 12 inches deep over the sand during the process of filtration. The quantity dealt with at these reservoirs varies from 400,000 to 600,000 gallons per day; and, after being filtered, it is passed into the open service reservoirs, which have a joint capacity of about 7,000,000 gallons. On an average, each bed runs for about seven or ten days before the top 2 or 3 inches of sand has to be removed. Thorough washing of the sand up to 6 or 9 inches deep takes place every two or three months; and the whole depth of sand is removed and cleansed once or twice a year.

The water is drawn into the town by means of automatic syphon outlets carried over the north embankment, and provided with chambers and indicating gear for controlling the sluices fixed on the inside slopes. In connection with these works, which constitute the low-pressure supply, 40,000 to 60,000 gallons of water per day is derived from a spring situate in Haverah Park, at an elevation 500 feet above Ordnance datum. A constant supply is maintained in the town under pressures varying from about 20 to 100 lbs. per square inch, through a circulating system of piping upwards of 40 miles in length, from 3 to 15 inches in diameter. Dead-ends are avoided as much as possible; and where they exist they are provided with wash-outs. Trunk mains are used as carriers only; the house connections being made to service-pipes laid down in each street, with stop-valves. Main valves are fixed at convenient points, for dividing the town into districts—a system found useful for detecting waste of water. Ball hydrants are also placed about every 100 yards. All fittings used in connection with the supply are approved and tested to 300 lbs. per square inch by the Company; and a code of rules and regulations, together with a list of authorized plumbers, is in operation. There are about 35 water-meters in use.

REGISTER OF PATENTS.

Measuring the Density of Gases.—Haddon, R.; communicated by W. Dürr and A. Custodis, of Munich, Germany. No. 13,035; July 15, 1892.

This is an apparatus constructed on the same principle as the gas-balance introduced some years ago by Herr F. Lux—see JOURNAL, Vol. XLVII., p. 72; and Vol. L., p. 177.

In appliances of this type, a balance-beam carries at one end a closed globe, and at the other end a counterweight; there being an indicator and scale provided for reading the density of the gas surrounding the apparatus, indicated by the inclination given to the beam by reason of the difference in density between the gas and the air or gas within the closed globe.

The object of the present invention is to provide means for automatically correcting the variations in reading produced by variations of pressure or temperature—in other words, to automatically reduce the reading to that for standard pressure and temperature. It has been sought to effect this by means of a shifting body of liquid—such as mercury or sulphuric acid—which seals a body of air in a small cavity. This body of air, being subject to compression or expansion corresponding to the barometric pressure and temperature existing at the time of observation, causes the liquid to shift to and from the vertical plane of the fulcrum of the balance; and consequently its centre of gravity and moment is altered with regard to the fulcrum. It is, however, found that with such a compensator the apparatus cannot be constructed with sufficient delicacy, owing to the large amount of movement which must be given to the liquid, to produce its full measure of compensation. It is proposed, therefore, that the tube which contains the liquid shall be so arranged beneath the fulcrum and in the line of the balance, that its centre of gravity in the normal condition occupies as nearly as possible a position in the vertical plane of the fulcrum of the balance. Thus a very small movement of the liquid to the one or other side is sufficient to produce a moment of great compensating value.

Regulator for the Gas Supply to a Steam-Boiler.—Gardner, L., of Manchester. No. 13,363; July 21, 1892.

The object of this invention is to so regulate the supply of gas to a burner, that a constant steam pressure may be maintained in a boiler heated by a gas-flame.

The patentee proposes to connect a cylindrical valve with the index axis of an ordinary steam-pressure gauge, in such manner that the valve turns with the axis. The valve is contained within a cylindrical shell; and this again is contained within a cylindrical case forming part of, or fixed to, the case of the pressure-gauge. These parts fit nicely the one within the other. The shell is capable of being turned round within the outer case, by means of a milled head at its rear end. A pin projecting forward from the shell moves a second index or pointer, mounted upon the axis; and it marks upon the dial of the instrument the pressure and temperature to which the apparatus is adjusted. The case in which the shell turns has two nozzles fixed on its exterior—one to serve as the gas-inlet, connected with the supply-pipe; the other to serve as the outlet, and connected with the burner. The shell has two annular grooves on its exterior, which serve as passages for the gas. The gas from the inlet nozzles enters one of the grooves; and by a perforation, it passes within the shell. The cylindrical valve within the shell is open at its rear end, so that the gas is able to enter also within the valve; and there is a narrow slit in the side of the valve, by which the gas can issue when the slit is uncovered. The slit in the valve is uncovered so long as it is opposite any part of a wide hole in the shell; and the gas then passes through the hole into the exit groove of the shell, and thence to the exit nozzle and burner. The movement of the cylindrical valve caused by an increase of steam pressure, ultimately causes the slit in the valve to pass the edge of the hole in the shell; and then the gas supply is cut off. This takes place sooner or later, according to the position to which the shell has been set by turning the milled head upon it.

Manufacture of Gas.—Parkin, B., of Golcar, near Huddersfield. No. 14,490; Aug. 14, 1892.

The patentee proposes to make gas from "petroleum, benzoline, or from other spirits of a like character," caused to pass into a heated

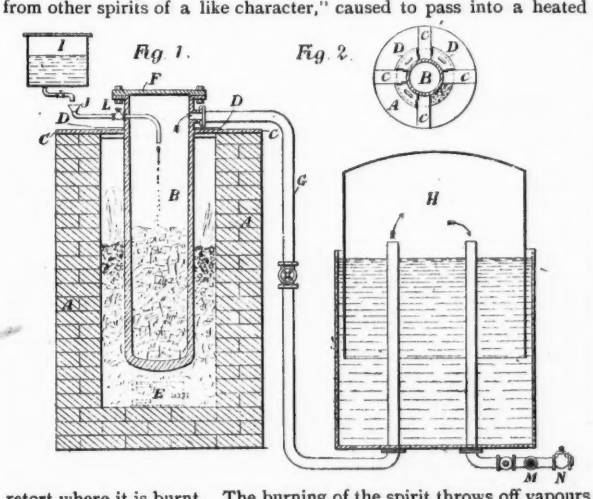


Fig. 1.

Fig. 2.

retort where it is burnt. The burning of the spirit throws off vapours or gases, which are conveyed away for use, either for illuminating or heating purposes.

A is brickwork, in which is a furnace containing a retort B, provided with four wings or arms C (shown also in fig. 2), resting upon the top of the brickwork, for the purpose of supporting the retort. Between the angle of each arm is a lid or cover D, removable when feeding the furnace with fuel. At the bottom of the furnace is a door E, for cleaning out the furnace. The upper end of the retort is sealed by a lid F; and the retort communicates by a pipe G with an ordinary form of gasholder H—a valve being used to shut off or open communication between the two. The petroleum spirit is placed in the cistern I, and is conveyed by the pipe J into the retort; a valve L regulating the passage of the spirit. The retort is partially filled with asbestos, broken bricks, or other porous material; and on the spirit dropping into the heated retort, it is burnt—the vapour arising therefrom forming a gas, which is conveyed by a pipe G into the holder. The asbestos or broken bricks lodging in the bottom of the retort are not essentially necessary for gas-making purposes; but they prevent the retort from being cracked by the cool oil falling upon the bottom of the heated retort.

Gas made in this manner may be mixed with coal gas; the pipes supplying the two gases being suitably arranged, as at the foot of fig. 1. M is a pipe for conveying the "improved" gas; and N is the cock attached to a pipe conveying coal gas. These two pipes may be suitably coupled together, for the purpose of collecting and combining the two gases, and conveying them to any place where required. In connection with the vessel I, which contains the petroleum spirit, an arrangement of valve and ball is employed, in such a manner that, when the holder is full, the upward movement of it at a given point could be arranged to shut off the petroleum; but, when the holder is empty, the downward motion at a given point would open the inlet for petroleum, so that the manufacture of gas may be resumed.

Manufacture of Briquettes from Small Coal, &c.—Huttemann, G., of Wiklitz, and Spiecker, G, of Bonn, Germany. No. 18,605; Oct. 18, 1892.

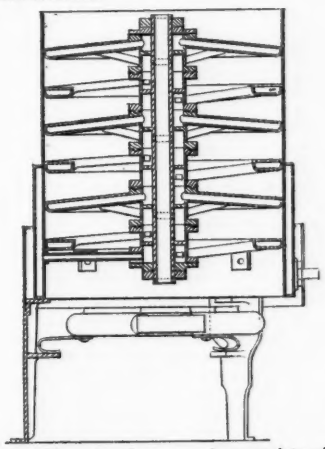
This invention relates to the manufacture of blocks or briquettes of fuel from small coal, slack, coal dust, coke dust, or the like, by mixing them with a binding agent consisting of the resinous pitch which is obtained as a residue in the distillation or boiling (at a temperature of about 300° C.) of the resins extracted from the coniferæ, and from which the resin—called pinolin—has been practically eliminated by such distillation or boiling, and then compressing the mixture thus obtained in any of the well-known form of press.

Gas-Actuated Pump.—Lake, H. H.; a communication from T. Backeljau, of Gand, Belgium. No. 5256; March 10, 1893.

This invention relates to a pump, in which the delivery and suction take place by successive expansions and contractions of a mixture of denoting gas in immediate contact with the liquid. The pump comprises a cylinder in which the explosions take place, terminating in a valve-box, and surrounded by a cooling cylinder, terminating in the delivery-pipe. The whole is surrounded by a cylinder forming an air-chamber. The igniting-device comprises a small platinum tube, designed to receive the combustible mixture and terminating opposite to a platinum cup, with the object of heating the small tube to incandescence—the tube and the cup being enclosed in one or two concentric metal tubes.

Heating Water by Gas.—Wright, G. E., of Birmingham. No. 7997; April 20, 1893.

This gas water-heater consists of an open-ended cylindrical casing containing a series of water-circulating sections, arranged so as to divide up the water contained therein into very shallow streams, and cause the heat from the gas-burner to pass up in a tortuous manner under and over the sections.



The water-heater shown in the engraving consists of six sections of circular form, enclosed in a thin metal cylindrical casing open top and bottom. Each section consists of a separate thin hollow disc-like casting, the top and bottom plates or walls of which are near together—say, about ⅛ inch apart. There are four vertical openings in each section, extending from the central boss for a certain distance towards the periphery. Thus the portions of the section between these openings form four passages communicating with the boss and the outer portion of the section. Two of the passages slant upwardly from the periphery, and enter the boss near the top; the other two passages slant downwardly from the periphery, and enter the boss near the bottom. The boss is flanged top and bottom, so as to joint on to the corresponding flange of the next section. The sections are secured together by a central tube which passes through the sections, being screwed up tightly, so as to close the hollow bosses of the top and

bottom sections. The lower part of the outer casing may have a water jacket to help to heat the water. An ordinary atmospheric gas-burner is used; and the heated air from it rises up through the various sections, in a tortuous manner, and travels under each of the sections in turn—thus thoroughly heating the sections and the water circulating through them.

Gas-Heated Stoves.—Scott, J., and Darwin, H., of Glasgow, and Darwin, S. B., of Portsmouth. No. 5665; March 16, 1893.

This invention—relating to gas stoves, cooking-ranges, ovens, and the like—has mainly for its object to utilize some of the heat arising from the ordinary gas-flames, for heating water contained in a tank located outside the stove.

The range may be of any ordinary construction, with a boiler fitted at one side. A multitubular heater is, preferably, so located above or near to the gas-jets, as to be heated by the spare heat given off by them. The heater is made in the form of a tube, pierced vertically with a number of holes, in which short cross tubes are fitted. Water from a reservoir or cistern above the boiler is admitted to the heater, so as to flow along a tube which, in its passage, is heated by the flames or hot air or products of combustion, passing through the vertical tubes. The hot water passes out of the heater by a branch-connection, into a circulating boiler or tank. Water from the boiler also passes to the branch heater. By this arrangement, a constant circulation is maintained; and the water in the boiler is kept heated ready for use. A pipe connection leading from the top of the boiler to the supply cistern, allows steam to escape thereto and be condensed; and there is also a pipe-connection, for supplying cold water from the cistern to the branch of the heater.

APPLICATIONS FOR LETTERS PATENT.

12,479.—Milne, J., and Schwaben, H. W., "Gauges for showing the column of water supported by the pressure of air or gas contained in pipes, gasholders, or other vessels." June 26.

12,483.—Puplett, S., "Valves for regulating the flow of fluids." June 26.

12,569.—The Scottish Gas-Stove Company and Scott, J., "Boilers for gas-cookers." June 27.

12,672.—Colquhoun, J. A., "Generating hydrocarbon vapour, and utilizing the same for heating and lighting purposes." June 28.

12,714.—Baggally, W. W., "A reflector for street-lamps." June 28.

12,762.—Felce, D. H., and Trelawny, J. H. S., "Appliance for starting gas or oil motor engines." June 29.

12,771.—Durr, L., "Self-generating gas or vapour burners." June 29.

12,782.—Wethered, O., "Supplying gas for the illumination of tramway cars and other vehicles." June 29.

12,917.—Pullen, W., "Oil, spirit, gas, or steam motor." July 1.

12,941.—Maiche, L. and C., "Purification of water." July 1.

12,990.—Winstanley, G., "Gas apparatus." July 3.

13,066.—Boult, A. J. "Incandescent mantles or filaments for use in connection with gas or electric incandescent lamps." A communication from O. H. Steuer. July 4.

13,069.—Boult, A. J., "Manufacturing fuel gas." A communication from E. Cowen. July 4.

13,126.—Young, W., "Production of illuminating gas and bye-products from liquid hydrocarbons." July 5.

13,163.—Caldwell, H. M., and Tatham, J. E., "Distilling or cracking and gasifying hydrocarbon oils and the like." July 5.

13,185.—Hilton, J. H., "Carburetting gases." July 6.

13,239.—Davies, P., "Re-heating steam or air, and gas, after expansion in the cylinder of an engine." July 7.

Wages at the Widnes Gas-Works.—At the meeting of the Widnes Town Council last Tuesday, Mr. Gough, in accordance with notice, moved that the workmen employed in the Widnes Corporation Gas-Works be paid at the following rates: Fitters, 36s. per week; and stokers, 5s. per shift. He said the plumbers at the present time were paid 32s. per week; while the fitters averaged 26s. to 33s. per week—the trade union rate of wages for this class of work in the town generally being 36s. per week. Alderman Williamson seconded the motion. The Chairman of the Gas and Water Committee (Alderman Timmis) contended that the wages of the men were equal to those paid in other towns; and the men were satisfied. It was a pity such a motion had been brought forward, to override the action of the Gas Committee, who had had the matter under consideration for two months. The motion, on being put to the vote, was defeated by 11 votes to 7.

Para Gas Company, Limited.—At the last general meeting of this Company, a suggestion was made that a half-yearly meeting should be held in the present month, to enable the Directors to lay before the shareholders their views as to the future of the Company. The meeting is called for Thursday next. The accounts to be submitted, covering the six months ending March 31, show a slight improvement over those of the previous half year; but the Directors state that while the necessary repairs and renewals which they have been enabled to effect, owing to the more punctual payments for the public lighting, have not yet had time to benefit the returns for gas, the outlay upon them has, of course, absorbed much of the profit. The tenders that were advertised for lighting the city, and referred to in the last report, were not accepted; and a further advertisement, inviting other tenders, returnable on the 1st of November, has now been published, and is engaging the consideration of the Directors. Mr. Cocks has recently retired from the managership of the Company; and the Board have appointed in his place Mr. Hislop, late Assistant-Manager, in whose competence for the office they have much confidence. Should the contract be further extended, it will be desirable to renew several of the mains and services; and the Directors hope there will be no difficulty in arranging with the authorities to supply the necessary funds to meet this expense. The shareholders will, however, they say, readily appreciate the impracticability of further capital outlay under this head, pending a renewal of the contract on a satisfactory basis.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by our correspondents.]

London Gas-Testing Regulations.

Sir,—"I am very displeased with you," was the greeting of Mr. Vernon Harcourt on meeting me yesterday. This was in reference to my evidence relating to the Referees on the Crystal Palace District Gas Bill, as reported in the Journal. He also said I "ought" to write you a letter, to put the matter right. For a public man not always very considerate of other people in his remarks, Mr. Harcourt is—like his pentane flame—too sensitive. He takes what is said too literally, and in a sense that a little consideration would show was not intended. But I am ready to do anything in my power to set his mind at rest.

The only part that I can see, in your *accurate* report, that can have troubled Mr. Harcourt, is where I was asked by Counsel what was "the effect of the action of the Referees within the Metropolis," and "Do you consider such action on the part of the Referees is necessary?" &c. To these questions, I replied very plainly and unreservedly. A most unwarrantable attempt was being made to bring the Company under the Referee or Metropolitan system; and I confess that I resented it energetically. In this action I had the full support of my colleagues, who had, before the case came on, definitely instructed Counsel to withdraw the Bill if the Committee should impose the London system of testing, &c., on the Company. It is of the Referee system, not of the men, that I complain.

When engaged before a Committee, Counsel cannot take five minutes to frame a question, nor can a witness occupy a quarter of an hour over an answer. Consequently, a single word or term, perhaps not quite scientifically accurate, is commonly used to convey a meaning which answers the purpose in this rough work-a-day world. I suppose the words that gave offence to Mr. Harcourt were "the action of the Referees," which were used both by the Counsel and myself as expressive of the entire system of Metropolitan gas-testing, of which the Referees are an essential part, but only a part. To have been completely accurate, the first question above quoted should have been put as follows, only Counsel could not possibly have so put it for the simple reason that the necessary information or instructions had not been given to him: "*What do you find to be the effect of the action of the Referees?*"—that is, of the costly and troublesome system by which the supply of gas in the Metropolis is regulated, including not only the action of the Referees with their "Instructions" and regulations (as to purity and quality, the provision of testing-places and apparatus, and testing), but of the London County Council, with their little army of testers, their Superintending Gas Examiner, their portable or peripatetic photometers, their Committees and Solicitors; also the Chief Gas Examiner and the Board of Trade; and, finally, the Police Court, where the Gas Companies are denied the common right of being heard in their own defence, and where the Magistrate is deprived of his judicial power—"*within the Metropolis.*" Only the part quoted and italicized is the original question; all the rest being implied and in my mind when giving my answer.

It was against the extension of this system (introduced in 1868, but never extended) that I was contending; and it is a very great satisfaction that Parliament has refused to extend a system, happily nowhere else in existence, which is intolerable to the gas managers of London, that works to the detriment of the gas consumers, and creates and maintains antagonism between the public authorities and the Gas Companies, who might be, and ought to be, working amicably together for the public good, as they are doing elsewhere.

I cannot do better than conclude with an extract from Sir Thomas (now Lord) Farrer's evidence before the Labour Commission on Jan. 27 last, in which he gives a quotation from an article of his in the *Quarterly Review* of Oct., 1871, reprinted in his little book called "The State in Relation to Trade." Speaking of railway, gas, water, and other companies, he said: "There are many points in which the interests of these companies are at variance with those of the public; and the conditions which the State has imposed on them, for the purpose of preventing their monopoly from being injurious to the public, are still tentative. These remedies have often proved inadequate, *and sometimes mischievous;* and, whilst it is right and necessary to impose some restrictions on them, *yet without great caution and wisdom, such restrictions are likely to be injurious to the public as well as to the companies.*"

I have italicized those parts of the quotation which receive forcible illustration from the London gas-testing regulations.

George Livesey.

July 14, 1893.

The Projected Amalgamation of the Water-Gas Companies.—At a meeting of the Committee of the dissentient shareholders of the North British Water-Gas Syndicate, Limited, held in the agent's office, in Glasgow, last Tuesday, when the result of the meeting on the 29th ult., as reported in the Journal for the 4th inst., was considered, it was resolved to press the action taken against the parent Company, with a view to secure the retention of the £12,000 in hand, to oppose amalgamation, and to refuse payment of any call made, as also to recover the moneys paid for patents.

Bradford Corporation Gas and Electricity Supply.—At the meeting of the Bradford Town Council last Tuesday, the Deputy-Chairman of the Gas and Electricity Supply Committee (Mr. J. Kay) moved the adoption of the proceedings of that body, from which it appeared that, at one of the meetings, an opinion was expressed that it was desirable the gas supply in the whole of the borough should be in the hands of the Corporation; and that, subject to the approval of the Council, the Town Clerk should be instructed that, on the occasion of the next application to Parliament, power should be sought to include the whole of the borough within the area of the gas supply. The minutes contained particulars of correspondence and interviews with Lord Kelvin as to the mode of extending the electricity supply works; and his Lordship's report was given. It was stated that Lord Kelvin had been invited to meet the Committee in Bradford at an early date for the purpose of conferring with them before the course to be taken was determined upon. The minutes were approved.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week :—

Bill read a second time : St. Helens Corporation Bill.

Bills reported : Aberdeen Corporation Bill ; Greenock Corporation Bill ; Liverpool Corporation Bill ; Water Provisional Orders Bill ; West Hampshire Water Bill.

HOUSE OF COMMONS.

The following progress was made with Bills last week :—

Bills reported : Accrington Gas and Water Bill ; Frimley and Farnborough District Water Bill ; Gas Orders Confirmation Bill (Newent, &c., Orders).

Bills read the third time and passed : Crystal Palace District Gas Bill ; Gas Orders Confirmation Bills.

HOUSE OF COMMONS COMMITTEE.

(*Before Mr.* A. de Tatton Egerton, *Chairman ; Mr.* Hugh Hoare, *Mr.* A. Holden, *Mr.* J. Scott-Montagu, *and Mr.* Bonham Carter, *Referee.*)

Wednesday, July 12.

ACCRINGTON GAS AND WATER BILL.

The proceedings on the above Bill, involving an investigation into certain charges brought by the Accrington Corporation as to the manner in which the accounts of the Gas and Water Company had been kept, were resumed to-day, having been adjourned from June 14.*

Mr. Littler, Q.C., Mr. Meysey Thompson, Q.C., and Mr. Ernest Baggallay again appeared for the Company ; Mr. Pember, Q.C., Mr. Cripps, Q.C., and Mr. J. D. Fitzgerald, for the Corporation.

Mr. Littler said the Committee were quite alive to the position in which the matter was left on the last occasion. His clients had since then had the opportunity of examining the twenty-five sheets of allegations which had been formulated by the Corporation, and which he found went back as far as 1878. He complained that the representatives of the Corporation had, in going back beyond ten years—over which period they were to be allowed to see the books—made use of information which they had gained under an arrangement which was to be without prejudice ; and that, in fact, it had been obtained in an unprofessional, surreptitious, and improper manner. He proposed to go through the allegations in the reverse order, taking those of the latest date first, and going back so far as might be useful for the purpose of the Committee ; and he asked the Committee to say that the investigation should not extend beyond the ten years. He should be able to show that not one of the points raised made the slightest difference to any gas consumer.

Mr. Cripps remarked that he desired absolutely to deny any suggestion of unprofessional, surreptitious, or improper conduct ; and he said that the arrangement come to on the last occasion was that they should have the books for the last fifteen years.

The Chairman said that, looking to what Mr. Cripps had stated, and the further offer of the Directors to give inspection of the books back to 1878, and the allegations having been formulated as from that date, the Committee were perfectly ready themselves to go back to that period.

Mr. Littler said he had not the slightest knowledge, at the time he made the offer of the books back to 1878, that the information had been obtained as it was. But the promoters were not bound to go back farther than they considered necessary ; and he hoped, if the Committee found on going back to a certain time that the allegations were utterly unfounded, they would not go beyond that.

Mr. Cripps said that Mr. Littler might conduct his case as he liked ; but in cross-examination he (Mr. Cripps) was entitled to go back to 1878. Mr. Littler would take the risk of his own case ; and he (Mr. Cripps) would take the risk of his.

The Chairman said the suggestion as to unprofessional conduct was immaterial. If a certain sum of money in 1882 was untraceable, in common-sense it must be traced back to 1878, if necessary.

Mr. Littler said he had not the slightest objection to going back to the year 1854, if necessary ; but he had some regard for the time of the Committee. The Company had not done anything of which they were ashamed, although he was quite sure the Corporation, in that time, had done many things that they ought to be ashamed of.

Mr. Cripps : Hard words break no bones.

The Chairman said the Committee had to decide what should be the standard price of gas ; and it was a material factor, in order to arrive at that, how the revenue had been dealt with, and how the advantage to the consumer in the past could be sustained. The Committee would determine in their own discretion when to stop.

Mr. *John A. Carse* (of the firm of Messrs. John Adamson and Co., of Manchester), F.C.A., was then examined by Mr. Baggallay, and said he had gone carefully into the allegations made by the Corporation. The substance of the allegations was that large sums of money had been paid out of revenue on capital account ; but the conclusion he had come to, after an investigation of the books, was that, although there had been one or two clumsy errors, and the book-keeping had been rather bad, they had not affected the consumer.

Mr. Baggallay : Have you examined the books to see whether a charge could be supported that the Company had manipulated their books with any object of prejudicing the interests of the consumer ?

Witness said they could not have any motive in doing so, because £25,000 at that date was due to shareholders for dividends, so that the object would be to show the profits at the highest possible rate. None of the alterations which had been made had been with the view of injuring the consumers of gas or water. The practice had been for the Clerk of the Works each half year to prepare a skeleton account without the figures, corresponding to the previous half year ; and the Secretary had then filled in all the figures. Where new entries had been required to be made, the Secretary had filled them in himself, which was the explanation of the handwriting and the figures being done by two different persons. At the end of the half year, when the Directors went through the accounts, they had to see what liabilities they had to put in for renewals of plant, and so on ; and those entries were all made before the audit. It was a common practice with companies to have such a draft report.

The Chairman : Has not that arisen from a wish on the part of the Secretary to prevent leakage of official information ?

Witness did not think that was the reason ; but the skeleton was made out to save the time of the Secretary.

Mr. Baggallay said the accounts were subsequently printed and published, so that the question of leakage of information could hardly arise.

Witness, in further examination, said that the accounts agreed exactly with the published balance-sheets in the results ; and were the same item for item, except where they had to group several things in one. He was then examined with reference to specific items of the allegations ; the first being with regard to sums in respect to new offices being charged to revenue account, whereas the Corporation alleged they should have been charged to capital. Witness explained that the Company had had to pull down their old offices, and build new ones ; and at the commencement of the work, they allocated a sum of £2000, which was part of the liability under the contract for £5551. They might have put the total amount in for that half year if they had liked ; but they chose to do it as they went along. Of the total sum spent on the offices, £500 had been allocated to capital, and £5051 to revenue. He considered that a reasonable allocation. It was a case of reconstruction entirely, except that the new offices were rather larger and better than the old ones ; and it was in that respect that the sum of £500 had been placed to capital account.

It having been decided to complete the examination of each item before proceeding to the next, witness was cross-examined by Mr. Cripps, who remarked that he would not dispute that renewals and replacements should be charged to revenue ; but it was a question of the allocation of the proper amounts. He suggested to witness that the old offices stood in the books at £1000. Witness referred to the ledger, and said that there was an item in 1882 of £12,000 ; but that did not all apply to the old offices, because there were offices in the works as well as on the old site. In the balance-sheets, a portion of the amount spent on new offices had been charged to revenue account as repairs and maintenance, where it all ought to have been charged to capital. A balance of £418 of the new office expenditure had been written off, and been charged to retort repairs.

Mr. Littler submitted that it did not matter under what head it was charged, so long as it was properly revenue expenditure, and charged in the revenue account. He asked that the Counsel for the Corporation should be confined to the charges they had made.

Mr. Cripps said that the allegation was twofold—manipulation of accounts as between revenue and capital, and fictitious entries, by putting down expenditure for retort repairs and other matters, when no such expenditure had been incurred.

The Chairman stated that the real question was that the items had been wrongly charged to revenue instead of to capital. Anything that went beyond that became a criminal question, into which the Committee would not enter.

Mr. Cripps said that, if the sums paid for new offices had been entered under the proper head, whether it was a proper charge or not could have been raised by the consumers, and they could have gone for a reduction in price. There was nothing criminal in it at all.

Witness, in further cross-examination, said that only about £1000 of the expenditure on the new offices appeared under that head, the rest having been charged to repairs and maintenance of works and plant. The Company chose to make a new heading in their accounts, showing the alteration of offices ; but they need not have done so, as it could have been all charged under the head of repairs. It was, no doubt, irregular to enter the £418 as retort repairs ; but it affected nothing whatever. It was also irregular, as a matter of account, to put one half of the £2000 for new offices in the first instance to maintenance of works and plant, and the other half to the specific head of new offices.

In re-examination by Mr. Littler, witness said that, under the Gas-Works Clauses Act, the consumer was not entitled to information as to what the money had been specifically spent upon, as the repairs and renewals would be all entered in one lump sum. Every shilling of the money charged had been expended ; and there had been no improper charging to revenue instead of capital. The books were perfectly straightforward.

Mr. *Alfred Lass*, F.C.A., said he had had large practice in dealing with the accounts of gas and water companies ; and he concurred with Mr. Carse that there had not been any improper charge to revenue with respect to the new offices. As a matter of principle, renewals and repairs must be charged to revenue.

The next allegation entered into was with regard to Mitchells House Reservoir No. 1, in respect of which it was submitted that there had been improper apportionment between revenue and capital ; that there were entries in different handwritings, in several cases made after the half year had closed ; and that there were interlineations for the purpose of reducing the apparent profits, so as only to allow of the payment of the maximum dividends and a small balance to be carried forward.

Mr. *Carse* was examined with reference to this allegation ; and he stated that the amount expended on the work between December, 1883, and December, 1890, was £15,800 10s. 7d., of which £5592 had been charged to capital and the balance to revenue. A considerable proportion of the £15,000 was expenditure for tightening the existing reservoir embankment, which was properly chargeable to revenue ; while that which represented the increased capacity given to the reservoir had been properly charged to capital.

Mr. *Lass* was also examined upon this item, and corroborated the evidence of Mr. Carse. He understood that the cost of repairing the

* See Journal, Vol. LXI., p. 1220.

leaking reservoir had been allocated to revenue; while the extension of the reservoir ought to be charged to capital expenditure. The actual amount to be allocated one way and the other could only be ascertained by reference to the engineers.

Mr. *Bryan*, M.Inst.C.E., was also examined; and he agreed that the sum for tightening the reservoir should go to revenue, and that the cost of improving or extending it should go to capital. He had measured the increased height of the embankment, and calculated what the cost of the work would be; and his view was that the amount allocated to capital should have been £1500 less than what had been charged. In reply to the Chairman, witness stated that in his estimate of capital expenditure, he included the cost of thickening the banks and walls of the reservoir.

The next allegation examined into was with reference to a sum of £480, which it was alleged had been improperly transferred from capital to revenue, and disguised under the heading of "Repairs to retorts."

Mr. *Carse* said that this was a sum expended for the purchase of a piece of plate for presentation to the Consulting Engineer, who was also a Director of the Company; the presentation being made to him for the reason that he had acted as Consulting Engineer for a considerable number of years without salary. It was at one time inadvertently charged to the wrong account; but it was immediately afterwards transferred, and appeared under the head of "Salaries and wages" in the published accounts. Witness produced the minute of the Company's meeting authorizing the expenditure.

The CHAIRMAN remarked that he did not think they need go further into that item.

Mr. CRIPPS said that all the other allegations related to one particular matter—viz., that £6800 had been entered as against coal and cannel expenditure, of which not one penny had been expended for those purposes.

Mr. *Carse* was examined with reference to one item of £700, which had been charged by interlineation—the original addition having been erased, and the total increased by that amount. He said that it was placed to coal irregularly, having been expended on repairs to a leaking reservoir. It was properly a revenue item, and was charged in the revenue account; and it mattered not to the consumer or shareholder whether it was placed to coals or repairs. This observation applied to all the other items referred to in the allegations now under consideration. As an accountant, he should object to that; but Directors were always anxious not to show abnormal expenditure in their revenue account.

Mr. *Lass* was also called on this point; but he stated that he had nothing to add to what had been said by Mr. Carse, which he thought was a perfectly good explanation.

Mr. *Carse* was re-called, and examined generally as to whether there was, in any of the allegations, anything which affected the consumer; and he said there was not.

The CHAIRMAN pointed out that the petitioners, in their petition, alleged that the books had been manipulated and altered; and he asked witness whether he had come across any other alterations beyond those he had mentioned.

Witness said there were one or two; but they were all explainable. All of them were made before the revenue account was settled, and before the books were audited.

Mr. LITTLER intimated that this would conclude the case for the Company.

Mr. *Samuel Mosely*, F.C.A., of Manchester, was then examined by Mr. PEMBER on behalf of the Corporation. He said his examination of the books showed that the profits for the year 1891 amounted to £24,000; and they naturally came to the conclusion that there had been expenditure charged in previous years against revenue account, which produced the larger revenue in 1891. He found charges made to revenue by transfers from capital account, very frequently in a different handwriting, at the close of the half-year's accounts. Witness was being examined as to interlineations and erasures, when

Mr. LITTLER submitted that there had been no cross-examination of his witnesses on those matters, or he should have called further evidence. Mr. Pember was therefore debarred, by the rules of evidence, from going into them with his own witnesses.

Mr. PEMBER maintained that he had a right to examine on those points; and, if necessary, the promoters could call rebutting evidence.

The CHAIRMAN held that, as the Corporation had not raised the question in cross-examination, they had now lost their right to do so. That was what he understood had always been the practice in Committees. It was the common-sense view; and it was, in his opinion, the correct one. To rule otherwise, would make the inquiries before Committees interminable.

Mr. PEMBER asked that the Committee should adjourn, in order that he might be able to consider how he should shape his examination, under the circumstances.

This course was agreed to.

Thursday, July 13.

On the resumption of the proceedings this morning,

Mr. *E. Waterhouse*, of the firm of Messrs. Price, Waterhouse, and Co., was examined on behalf of the Corporation. He said that, in his opinion, the entire cost of the new offices should have been charged to capital account, and that the placing of £1000 to repairs and maintenance and £500 to retorts, when these sums had been spent on the offices, was misleading. He was further of opinion that the £2000 should not have been charged on account of the offices before the work was begun; the proper time for making the charge being when the architect's certificate was obtained, until which time there was no liability.

In cross-examination, witness said that, if it was a proper revenue charge, there was no harm done to the consumer. He had not seen the offices; and he did not know what they were in substitution for, except that he had heard them described in the evidence on the previous day. The £1000, the cost of the old site, would be the only sum that should be charged in the revenue account.

Mr. LITTLER: Assuming all that the other side say to be true, what reduction would it make in the price of gas at the present day?

Witness: I do not think I can go into that.

If you did, would it not be represented by something like one-thousanth of a farthing?—I do not know.

The CHAIRMAN: Supposing a property is bought originally for £1000, it being then ordinary cottage property, and it becomes of value owing to its being used as offices, would you not put down an enhanced value for that?

Witness: Certainly not. It should stand in the books at the original value for all time, until the enhanced value was realized.

Witness was then examined as to the sum of £15,800 for the Mitchell's House reservoir No. 1, which he said was taken to the capital account in the ledger, and in the personal ledger was also credited to capital account; and the allocation between revenue and capital was subsequently made.

The CHAIRMAN asked if it would be within the competence of a clerk to decide what was revenue and what was capital.

Witness said it would not; but it would be left to the Engineer, who, before the work was commenced, would prepare an estimate of what would be capital expenditure and what would be renewal. There was no reference in the books, as he would expect to see, to any report and estimate; but a lump sum was allocated from time to time at the end of the half year.

The CHAIRMAN said the Committee had it in evidence that such an allocation was made by the Engineer.

Mr. FITZGERALD said Mr. Bryan, who gave this evidence, was not the Engineer to the Company, but was merely called in, for the purpose of the Bill, to assess the value of the work.

Witness said the repair of the leakage of the reservoir might be either a capital or a revenue charge. If it were caused by a defect in the original structure, it should be placed to the capital account.

Mr. BAGGALLAY cross-examined the witness as to whether there would not be some difficulty in estimating in advance what would be the cost of stopping a leakage. It would not, he said, be so easy as estimating the cost of raising an embankment a certain height.

Witness said any engineer could give an estimate for the work.

Probably he would; and very likely the estimate would be wide of the mark. It would be as easy to go wrong in an estimate for the stoppage of a leakage as in everything, would it not?—It would.

Have you inquired what steps were taken by the Directors to determine how the allocation should be made which you say was an arbitrary allocation?—I have not.

Witness was next examined as to the £480 spent on a piece of plate for the Consulting Engineer (Mr. F. Longworth); and he said it depended upon whether the services were rendered on capital or on revenue account as to which account it should appear in. There could be no justification for entering it as retort repairs, or, as subsequently entered, to wages.

In cross-examination, he admitted that, if the amount were given in lieu of salary, it might properly be charged as salary; and that if it was for supervising work which should be placed to revenue account, it also might be charged to revenue.

Mr. BAGGALLAY: Is it not rather straining a point to say that, because it is stated to be in appreciation of long and valued services, and for saving the Company a large expenditure upon engineers and otherwise, it should not be treated as if it were salary, for the purpose of bringing it into the accounts?

Witness: I think it would have been better to state it as it really was—a vote of the shareholders.

If back dividends to shareholders remained unpaid, it would have come out of the shareholders' pockets, and not out of those of the consumers?—It would not come out of the consumers' pockets until after the shareholders were paid.

Mr. BAGGALLAY: Yes; and we may look to next century for that.

Witness was next examined as to the £6800 alleged to have been charged to coal and cannel account, which had not been spent in this manner. He said the items were originally entered in the capital account in the books, and were for expenditure on Mitchell's reservoir No. 2, the Dean Clough drain, and the new purifiers. He regarded the entries as grossly untrue and misleading.

While the examination on this matter was proceeding, Mr. Pember and several of the parties, who had been engaged in negotiation outside, returned.

Mr. PEMBER informed the Committee that heads of agreement had been arrived at between the Company on the one hand and the Local Authorities who had petitioned against the Bill on the other, which were to the following effect:—

(1) The opposition is to be withdrawn, and the Bill is to proceed, except that the standard price is to be made 3s. 6d.

Of course, this would be with the assent of the Committee; and he presumed, as both sides were agreed on the matter, the Committee would not quarrel with it.

(2) The above-named Local Authorities, or such majority of them as hereinafter mentioned, shall purchase the gas and water undertaking of the Company upon the basis of perpetual annuities equal to the maximum dividends of the Company, to be secured as a first charge upon the undertaking, and as further security to be charged also upon the district rates.

(3) The agreement is to take effect as from the 31st of December, 1894.

(4) The unpaid debentures of the Company to be called up as and when the existing mortgages of the Company become due, and perpetual annuities to be issued with interest in respect of the issue of the debenture stock of the Company.

(5) The Company to retain the balance of £8087 12s. 7d. and £809 representing undivided profits in the revenue account on Dec. 31, 1892.

(6) The purchasing Authorities to pay to the Company a further sum of £5000 for their business.

(7) The servants of the Company, other than weekly servants, to be taken over for four years at least on the same terms as they now hold their appointments.

(8) The purchasing Authorities to promote a Bill next session to carry out this agreement, which the Company shall not oppose, except for the purpose of seeing that this provisional agreement is properly carried into effect.

(9) The purchasing Authorities to pay the costs of and in relation to the Bill of the Company and the Bill of the purchasing Authorities for the transfer of the undertaking.

(10) A formal agreement, embodying these terms, is to be made. If such agreement be not executed before Oct. 1, 1893, by a majority of the Local Authorities, such majority to include the Corporation of Accrington, this agreement to be void.

These heads were signed by himself and by Mr. Baggallay, as representing the other side; and he thought they ought to be scheduled to the Bill. He desired to make a few remarks on the subject of the great altercation which had been going on in that room for a long time. He wished to say most distinctly, so far as he understood the matter, there was no ground for a charge, and no charge was ever intended to be made, of any sort of irregularity which would reflect upon the personal honour of anybody connected with the Company. The Committee had the books before them, and therefore he need not state that there were certain irregularities in the keeping of them; but he repeated what he had said on the first day of the altercation—that he did not himself know, and had never heard of any irregularities, in connection with the books of the Company, as to which they might not say that they would be found in the books of a hundred other Companies. Having stated this many days ago, he thought he might now be taken to be sincere when he said (not because they had arrived at an agreement) that he declared he did not think there was any room for charges of irregularity which would reflect upon the personal honour of anybody connected with the Company. He regretted at the time that the idea was ever mooted that any such thing was intended; and he was quite sure Mr. Cripps did not so intend it. He would not have done it if he had been in the room; and he had never received any instructions which would have entitled him to suggest it. He (Mr. Pember) made this statement voluntarily, and of his own motion; and it was not to be regarded as having been made simply because the bargain had been entered into. He wished everybody to go away from the committee-room with a feeling of good-will, and with an expression of regret all round that there had been any kind of personal attack.

The clauses of the Bill were then passed, and it was ordered to be reported to the House.

The CHAIRMAN said, on behalf of the Committee, they were very glad indeed to have the agreement which the associated Local Authorities and the Company had arrived at, and equally so to hear the unreserved manner in which the Counsel for the petitioners had withdrawn every allegation, of any sort or kind, as to the manner in which the books had been kept, in view of the words used with the petition, which certainly were a little strong. But they had been unreservedly withdrawn; and he congratulated the parties on the settlement.

The proceedings then terminated.

Ackworth Water Supply.—The Hemsworth Rural Sanitary Authority have confirmed an agreement with the Pontefract Corporation to supply Ackworth with water at 8d. per 1000 gallons on a daily minimum of 20,000 gallons, or 7½d. per 1000 gallons if the average exceed 40,000 gallons per 24 hours. The cost of the scheme is estimated at £3800.

Projected Amendment of the Burghs Gas Supply (Scotland) Act, 1876.—A short Bill has been introduced to amend the Burghs Gas Supply (Scotland) Act, 1876, with which it is to be read and construed. It is specified by clause 2 as follows: "The provisions of the 18th section of the recited Act, which enact that the Commissioners for executing that Act shall not manufacture or store gas or any residual products upon any lands without the previous consent in writing of the owner, lessee, and occupier of every dwelling-house situate within 200 yards of the limits of such lands, shall be modified and altered to the following effect—viz.: Before proceeding with such manufacture or storeage, the Commissioners shall, in addition to making the return to the Board of Trade required by the recited Act, give notice, by advertisement published once a week for two weeks in any newspaper circulating within the burgh, of their intention to proceed with such manufacture and storeage; and in the event of any owner, lessee, or occupier refusing or delaying to give the consent provided for in the recited Act for more than ten days after the last date of publication of such advertisement, the Sheriff may, on the application of the Commissioners, and after such investigation and inquiry as he may deem necessary, by a deliverance under his hand, find and declare that such consent may be dispensed with, and such deliverance shall be final and not subject to review. In this section the word 'Sheriff' shall not include Sheriff Substitute."

The London County Council and Water Supply.—At the meeting of the London County Council last Tuesday, the Special Water Committee reported that they had before them an important report by the Chief Engineer (Mr. A. R. Binnie, M.Inst.C.E.) on certain areas, from which it was suggested that a considerable quantity of water could be obtained; but, before he could express a definite opinion on the practicability of adopting the suggestion, it was necessary that he should have the assistance of geological experts in certain investigations which they considered desirable. They therefore recommended that they should be authorized to incur an expenditure not exceeding £500 in employing geological experts to assist the Chief Engineer in investigating sources of water supply. Mr. Beachcroft moved that the question be postponed pending the report of the Royal Commission on Water Supply; but, after some discussion, this was withdrawn, and the Committee's recommendation agreed to. The Committee also reported that, having regard to the possibility of a decision to purchase the undertakings of the Water Companies, it seemed to them expedient that the Council should be acquainted with the financial affairs of these bodies, in order to safeguard the interests of the ratepayers should the question of the amount to be paid be referred to arbitration. They had caused the published accounts of one Company to be examined by a financial expert, who had made a report thereon; and they expressed the opinion that the accounts of the remaining seven Companies should be similarly dealt with. They therefore recommended that, subject to an estimate being submitted to the Council by the Finance Committee, as required by the statute, they should be authorized to incur an expenditure of £250 for obtaining a report on the accounts of the Companies. This was also agreed to.

MISCELLANEOUS NEWS.

METROPOLIS GAS SUPPLY.

The Quality of the Gas in the Past Quarter.

The following is an abstract of the report of the Chief Gas Examiner for the Metropolis (Dr. A. W. Williamson, F.R.S.) as to the quality of the gas supplied by The Gaslight and Coke, the Commercial, and the South Metropolitan Companies, during the quarter ending the 30th ult.:—

1. *With respect to Illuminating Power.*—The average illuminating power, in standard sperm candles, at each of the testing-stations, was as follows:—

The Gaslight and Coke Company—	
Fenchurch Street, E.C.	16·3
Kinghorn Street, E.C.	16·5
Dorset Buildings, E.C.	16·5
Ladbroke Grove, W.	16·4
Devon's Road, E.	16·3
Carlyle Square, Chelsea, S.W.	16·1
Camden Street, N.W.	16·4
George Street, N.W.	16·1
Graham Road, E.	16·5
Kingsland Road, E.	16·3
Spring Gardens, S.W.	16·2
Grove Gardens, St. John's Wood, N.W.	16·2
Hornsey Road, N.	16·5
Lambeth Road, S.E.	16·1
Millbank Street, S.W.	16·7
Commercial Gas Company—	
Parnell Road, E.	16·3
Wellclose Square, E.	16·4
South Metropolitan Gas Company—	
Hill Street, S.E.	16·5
Bedford Road, S.W.	16·2
Stoney Lane, S.E.	16·4
Lewisham Road, S.E.	16·6
Blackfriars Road, S.E.	16·6
Burrage Road, S.E.	16·2

It will be seen from these results that the average illuminating power was higher than the parliamentary standard of 16 candles at all the testing-stations.

11. *As regards Purity.*—Sulphuretted hydrogen was not present in the gas at any of the testing-stations. The proportion of sulphur in other forms averaged less than the amount allowed—viz., 17 grains per 100 cubic feet of gas—at all the testing-stations, more especially the Millbank Street, Devon's Road, Spring Gardens, and Lambeth Road stations of The Gaslight and Coke Company, the Wellclose Square and Parnell Road stations of the Commercial Gas Company, and the Hill Street station of the South Metropolitan Gas Company. Ammonia was generally present in the gas more or less frequently during the quarter, but only in slight quantities. The limit allowed was not exceeded at any of the testing-stations.

EXHIBITION OF GAS APPLIANCES AT LEICESTER.

Although gas exhibitions in general have a marked sameness, due to the fact that they are primarily designed in the interest of sellers of gas-cookers, the Gas Committee of the Leicester Corporation, at the exhibition held by them last week in the Floral Hall in that town, while giving gas cooking and heating its due prominence, very wisely added many exhibits of more than usual interest to the profession. Models, testing appliances, and the general scientific apparatus used in modern gas-works, are at least calculated to inspire the consumer with some degree of respect for the gas engineer, if only for the reason that they are evidence of the careful means which are daily employed to ensure him the quantity and quality of the commodity he buys; and the fact that these appliances are so rarely heard of, prove that they are not for show but for work. The principal exhibit in this department was an elegant pavilion erected by Messrs. Alex. Wright and Co., and Messrs. Thomas Glover and Co. It was most pleasingly decorated under the direction of Mr. Frank Wright, who spared neither trouble nor expense to make it as effective as possible. The large collection of testing apparatus shown by this firm was complete in itself, and included a Wright's improved standard Letheby photometer in action. This was fitted with a new arrangement for using candles or the Methven standard; the lights being placed at right angles to each other, so that either can be moved in or out of position at pleasure, and by a single movement. The meter as well as the clock is fitted with an audible signal, so that the operator has no need to look at one or the other. Porcelain is introduced with manifest advantage in the governor; and the same material is utilized in various colours and designs in the aneroid barometers—making them both very attractive. Another novelty was Wright's variable illuminating power standard, which consists of a Methven slit that can be varied from 1 to 10 candles by a simple movement. A complete set of leak indicators which might be tested, Wright's patent dial thermometers, Messrs. Humphreys and Glasgow's water-gas gauges, and some ingenious arrangements for self-inking pressure and other registers, were among the things which would most interest gas managers. Messrs. Thomas Glover and Co. showed several large meters; and also one of special interest, bearing the date 1844. A certificate hung near, showing that this instrument had been in use for 44 years, and on being tested in 1888 was found correct. Gas-engines were shown at work by several makers—one by Messrs. Wells Brothers, of Sandiacre, having been used for eight months in its present position to supply 160 16-candle incandescent electric lamps. It was stated to be of 17-horse power, and the gas consumption, to be 20 feet per horse power. Mr. C. R. Matthews, of Leicester, showed some gas blowpipes actuated by the breath or bellows, according to size. Each instrument is fitted with two slide-valves, which

can be readily moved by one hand, and are clearly marked gas and air. The flame can be altered at pleasure from a reducing to an oxidizing one, or varied to any degree within its limits. Gas for heating, especially in new houses, should receive an impetus from the inspection of Mr. G. T. Coleman's (Leicester) chimney-pieces, tiled hearths, and kerbs to match, each fitted with a gas-fire. They were exhibited in marble, slate, iron, ash, and walnut. Gas cookers were shown by the usual well-known makers; and, subject to approval, any maker was at liberty to secure customers for hiring. A great improvement was noticeable in a general adoption of white enamel crown plates, which Messrs. Richmond claim to have originated. The firm also use removable burners; rendering their cookers easy to clean and keep in proper order. The Parkinson cooker has been much improved. It is carefully made, and looks very substantial. There is fitted to these cookers a new grilling arrangement, formed of two flaps which work like trap-doors on a common hinge, and which fall out of the way when the burners are to be used for boiling alone. They are also fitted with dampers; and the top bars are serrated, to secure a more uniform heat. The Scottish Gas-Stove Company accomplish the grilling improvement by moveable burners, which strike either above or below the fret, as boiling or grilling may be required. They also utilize the waste heat from the oven to heat the boiler, instead of a separate burner being always necessary. Mr. E. W. Parish came out as a cooking reformer with a new steamer, consisting of two cylinders, so that the food, cooked by superheated steam, retains its juices, and it may be kept hot for any reasonable time without deterioration. It only remains to be said that the exhibition, which was carried out under the supervision of the Gas Engineer and Manager (Mr. A. Colson, M.Inst.C.E.) was opened by the Mayor (Mr. Alderman Underwood), and was well patronized, especially at night. The usual lectures were held twice daily by members of the Leicester School of Cookery, under the direction of Mrs. Buck; and the proceedings generally were enlivened by the strains of the Leicester Corporation Gas Department band, for whose admirable performances a special word of praise is necessary.

OPENING OF A LEEDS BRANCH OF MILNE & SON, LIMITED.

A new departure has been made by the old-established firm of Messrs. James Milne and Son, Limited, in the opening of a Leeds branch, for the control of their increasing business in the Midlands and North of England. Last Tuesday, the new premises, which are situated at No. 48, Wellington Street, Leeds, were formally opened in the presence of a representative gathering of friends connected with the district. During the inspection of the premises, which consist of five floors, satisfaction was expressed at the show-room and warehouse accommodation, and the convenience afforded for meter repairs in the floor set apart for this purpose. A large stock of gas-meters is kept on the premises, to enable the Company to deliver promptly. The prominence given to gas-fittings of all kinds exhibited on two floors, indicates that this is an important department of the firm's manufacture; while handsome window *grilles* in brass and copper show that Messrs. Milne have good claims to the title of "Art Metal Workers," in which department it appears they are making rapid strides. Water-fittings and plumbers' specialties have long been associated with Messrs. Milne's manufactures; and special interest was taken in the inspection of full-sized baths made of indurated wood fibre (an American product), for which the firm are sole agents in this country. The baths in question, being made from pure wood pulp, have the good qualities of wood baths, but without joint or seam. After being moulded, each bath is baked and treated, previous to a thorough enamelling process, in "Eburite," which is said to resist acids and alkalies as well as boiling water. "Vertmarche" gas-lamps are used in lighting the premises; and these are fitted with specially designed lever cocks, which stop at "half cock" on first lighting, to prevent the tendency to smoke before the lamps are heated, after which the cocks may be turned full on by a second operation. The lamps are fitted with cut-glass gobes, which give a brilliant effect. After inspecting the building, the party took luncheon—the Chairman of the Company (Mr. James Milne) presiding. Chantrey's bust of Murdoch occupied a prominent position in the room; and portraits of the former heads of the firm for four generations adorned the walls, together with photographic views of the Milton House Works, Edinburgh. After luncheon, a short toast-list was gone through. The toast of the day was proposed in eloquent terms by Mr. W. Barratt, of Grantham. In responding, Mr. D. Macfie (the Managing-Director of the Company) referred to the beginnings of the firm 150 years ago, when John Milne was a brassfounder and candlestick-maker on the Castle Hill, Edinburgh, and in 1756 had his portrait presented to him while "Deacon Convener of the Trades." Reference was also made to the former efforts of his grandson, James Milne, early in the present century, in connection with gas apparatus and fittings, and to the fact that Milne's Gas-Works lit up some business premises in Edinburgh prior to the formation of the Edinburgh Gas Company, and that Mr. James Milne was Engineer for several important undertakings at this period, including the City of Hamburg Gas-Works. Other toasts followed; and a pleasant afternoon was spent. Altogether, the impressions of the opening ceremony augur well for the success of the new venture.

Barnsley Water Supply.—The Local Government Board have sanctioned the borrowing by the Barnsley Corporation of £10,000 for the purposes of their water undertaking.

The Birmingham Corporation and Electric Lighting.—It was stated some time ago that the General Purposes Committee of the City Council had under consideration the question whether or not the Corporation should themselves obtain a Provisional Order for the supply of the electric light, and consequently oppose the extended Order asked for by the Birmingham Electric Supply Company. After careful inquiry, the Committee have decided that it would be inadvisable for the Corporation to undertake the supply of electricity; and they will report to this effect to the Council at the next meeting.

GAS PROVISIONAL ORDERS FOR THE PRESENT SESSION.

The Board of Trade have issued Memorandums stating the nature of the proposals contained in the Provisional Orders included in the two Gas Orders Confirmation Bills now before Parliament.

The first Bill comprises the Orders relating to Bromyard, Llanfairfechan and Aber, Otley, and Swindon. The Bromyard Order is to empower the Bromyard Gas Light and Power Company, Limited, to maintain and continue gas-works, construct additional works, and manufacture and supply gas within the town and parish of Bromyard and the townships or parishes of Linton and Winslow, all in the county of Hereford; also to fix the capital at £5000 by shares and £1250 by loan, and the maximum price to be charged for gas at 5s. 10d. per 1000 cubic feet. The Llanfairfechan and Aber Order is to authorize Colonel Henry Platt to maintain and continue gas-works, and to manufacture and supply gas in the parishes of Llanfairfechan and Aber, both in the county of Carnarvon, and to sell gas in bulk by agreement beyond the limits of supply; also to fix the capital for the purposes of the undertaking at £9657, and the amount which may be borrowed at £2414, and the maximum price to be charged for gas at 5s. 10d. per 1000 cubic feet, with power to the Board of Trade, after three years, to alter the maximum price, or to fix a standard price with sliding scale as to profits. The Otley Order is to enable the Otley Gas Company to purchase additional lands, and to supply gas in bulk, by agreement, beyond the limits of supply. The Swindon Order is to empower the Swindon Gas and Coke Company, Limited, to maintain and continue gas-works, and to manufacture and supply gas in part of the parish of Swindon, in Wiltshire, and to supply gas in bulk, by agreement, beyond the limits of supply; also to fix the capital at £16,000 by shares and £4000 by loan, and the initial price to be charged for gas at 4s. 3d. per 1000 cubic feet, with sliding scale as to price and dividend.

The second Bill comprises the Orders relating to Newent, Portishead, Sheffield, and Sligo. The Newent Order is to empower the Newent Gas Company to maintain and continue gas-works, and to manufacture and supply gas in the parish of Newent, in the county of Gloucester; also to fix the capital at £6000 by shares and £1500 by loan, and the maximum price to be charged for gas at 5s. 10d. per 1000 cubic feet, with power to the Board of Trade, after three years, to alter the maximum price, or to fix a standard price with sliding scale as to dividend. The Portishead Order is to authorize the Portishead Gas Company, Limited, to maintain and continue gas-works, and to manufacture and supply gas in the parishes of Portishead, Portbury, Easton-in-Gordano or St. George, and Weston-in-Gordano, all in Somerset; also to fix the capital at £19,000 by shares and £4750 by loan, and the standard price to be charged for gas at 4s. 6d. per 1000 cubic feet, with sliding scale as to price and dividend. The Sheffield Order is to confer upon the Sheffield United Gaslight Company power to construct additional works, and to create and issue debenture stock to the amount of £200,000. The Sligo Order is to authorize the Gaslight Company of Sligo to raise additional capital, not exceeding £6000 by shares and £1500 by loan; to extend the limits of supply; to enable the Company to supply gas in bulk, by agreement, beyond the limits; and to fix the standard price to be charged for gas at 5s. per 1000 cubic feet, with sliding scale as to price and dividend.

THE PRICE OF GAS IN THE CHARTERED COMPANY'S DISTRICT.

It may be remembered that meetings of gas consumers have lately been held in the district of The Gaslight and Coke Company, with the view of obtaining a reduction in price. At one of these meetings, Mr. J. Rowlands, M.P., occupied the chair; and a resolution was passed protesting against the high charge made by the Company for gas, as compared with the other London Companies, and calling upon the Directors to "give immediate and earnest consideration" to the question of lowering it. Mr. Rowlands forwarded a copy of the resolution to the Company's Secretary and General Manager (Mr. John W. Field), who a few days afterwards replied. He stated that the Directors had considered the resolution, and had instructed him to inform Mr. Rowlands that the advance from 2s. 6d. to 3s. 1d. per 1000 cubic feet in the price of gas in the Company's district was rendered necessary by the very considerable increase in the rate of wages paid to their workmen, and to the seriously enhanced price of coal, chiefly caused, as was represented to the Directors, by similar increases in the mining districts. In addition to this, there had been a marked fall in the price of coke, and of some other residual products. The first-named cause was still in operation; but the Directors were pleased to find that, as regards the cost of coal, they would shortly be able to effect a considerable saving. So that, unless badness of the trade of the country hindered improvement in the market for residuals, they would be able to notify some reduction in the present price of gas. Mr. Field pointed out that, to the extent that the increase in the price of gas had been brought about by the enhanced rates of wages obtained by the men in the Company's service, the consumer must be prepared for such increase to be a permanent addition to the price; for, certainly, the Directors had no intention of disturbing the existing arrangements with their workmen. Mr. Field concluded by reminding his correspondent that, under the present legislation affecting the Metropolitan Gas Companies, the rate of dividend payable by the Company is affected inversely by the price charged for gas; and that therefore it is to the direct interest, as well as being the desire, of the Company to see their gas at the lowest possible figure. This letter Mr. Rowlands brought before the Committee of the Gas Consumers' Protection League; and he subsequently wrote to Mr. Field to express their surprise at the reasons given by the Directors for the greatly increased charge for gas since 1890. He said the Committee failed to see that the conditions under which the Company were working were different from those of the two other Gas Companies supplying the Metropolis, and who charged their customers a much lower rate, or why The Gaslight and Coke Company should supply their South

London customers at 7d. per 1000 cubic feet less than those in the North. He was desired by the Committee to say that, so far as any extra charge was due to the increase in wages paid to the men, they did not want any alteration; and they certainly had no wish that the existing arrangements with the men should be disturbed. They added that, so far as their information was concerned, it differed from that of the Directors; the enhanced price of coal not being chiefly caused by the increase of wages paid to the miners. The Committee expressed their pleasure at the prospect of a reduction in the price of gas, and said they would be glad to be informed how soon it would take place, and what the amount was likely to be. In answer to this letter, Mr. Field explained that the conditions of The Gaslight and Coke Company were widely different from those of their neighbours. In the first place, the Company had been compelled by Parliament to close, in the interests of the residents of London, some of their in-town manufacturing stations, and to erect others in their stead at a distance of some ten miles from their district of supply. This necessitated a very heavy capital outlay, and entailed a permanent annual charge which must fall upon the consumer of gas. Secondly, at these new works the larger proportion of the coke had to be sold at what might be termed wholesale prices; and this seriously increased the net cost of the gas made there. Thirdly, a considerable portion of the northern district of the Company was supplied with gas made at stations on the canal; and there the cost of coal was greatly increased by the dues and lighterage charges thereon. These were only some of the disadvantages attending the Company's working, as compared with that of the two other Metropolitan Gas Companies, the effect of which was seen in the higher price their consumers had to pay. Mr. Field added that it would be premature to give any figures of the probable reduction in the price of gas, as this must depend upon the condition of trade generally, the character of the season, and other matters all equally impossible to forecast; but the public might rely on the reduction being as large as possible. In a postscript, Mr. Field explained the reason for the difference in the price charged on the South of the Thames, under the Scheme of Amalgamation with the London Company. This letter was simply acknowledged by Mr. Rowlands, who expressed his intention of publishing the whole of the correspondence. This he has since done.

THE CRISIS IN THE COAL TRADE.

The Position in Lancashire.

During the past week, meetings have been held of the various Associations connected with the Lancashire and Cheshire Miners' Federation, for the purpose of ascertaining the opinion of the men regarding the masters' proposal to reduce wages by 25 per cent.; and, according to the returns in the hands of the Executive, there is a unanimous feeling among the miners not to accept the reduction. The last and most important of these meetings was the one held at Bolton on Saturday. It was a special delegate meeting of the Ashton and Haydock Association, which has a membership of 20,000, and embraces the principal coal-fields in the Palatinate. There were no signs of wavering; and the motion to leave work on the 28th inst. was carried without a dissentient vote. It was stated at the meeting that the struggle will be far-reaching in its effects; and that the miners are in a position to hold out for a couple of months at least. One of the leaders announced that the London Coal Porters' Union and the Seamen's and Firemen's Union, with a membership of 50,000, will stand by the miners in the present struggle, and act as the Federation directs. There is also a probability that the men in the districts not now included in the Federation will join the movement rather than let the employers win the day. There are many of the colliery-owners in Lancashire who have not given their men notice of the reduction, and who would prefer to continue working; but, as already pointed out, this cannot be allowed under the rules of the men's Federation. All miners are expected to bring out their tools on the 28th, whether or not they have received notice. The men in the Rossendale Valley are excepted, because in that district they are paid on the sliding-scale system. In some places in Lancashire, the notices expire on the 24th, as is the case with the collieries of the Bridgewater Trustees; but the men are trying to bring about an arrangement that work shall be continued until the 28th. The near approach of a strike in the coal trade is having a decided effect upon the market; and prices are advancing already. Millowners and other large employers of labour outside the coal trade are laying in stocks; but there is not the same uneasiness shown generally as was the case three years ago. A conference of the delegates to the Lancashire and Cheshire Miners' Federation was held yesterday in Manchester, for the purpose of receiving reports from the various districts on the proposed reduction, and instructing delegates as to what course to adopt at the Birmingham conference, which opens to-morrow. Mr. S. Woods, M.P., presided. About 40,000 miners were represented; and reports were submitted from all the districts, showing a unanimous vote against accepting any reduction. The delegates to the Birmingham conference were instructed to vote accordingly, and also to oppose the proposal for arbitration. It was also recommended that those men who had not received notice should give notice to terminate their engagements on the 28th inst., and that not more than five days should be worked during the notice.

Lancaster and the Electric Light.—Last Wednesday, Major-General Crozier, R.E., held a Local Government Board inquiry into an application made by the Lancaster Town Council for sanction to borrow £25,000, the estimated cost of a system of electric lighting installation for the borough, to be provided by the Brush Electrical Engineering Company, of London. For the present the Corporation propose to light only the main streets in the centre of the town; but arrangements are being made for additional plant to be put down as required.

THE ST. PANCRAS ELECTRIC LIGHTING SCHEME.

Suggested Combined Dust Destructor and Electricity Station.

Reference has already been made in the JOURNAL to the proposal of the St. Pancras Vestry to establish a combined dust destructor and electricity station in connection with their electric lighting scheme. The following particulars in regard thereto are taken from a joint report presented to the Committee who have the matter in hand, by Professor H. Robinson, the Electrical Engineer, and Mr. W. N. Blair, the Engineer and Surveyor to the Vestry.

The principle of the disposal of refuse by means of destructor cells is now well recognized; and it is being carried into effect by local authorities throughout the kingdom. The heat from the cells can be utilized in various ways, such as by passing it through the boilers and economizer required by the electric light station, or by carrying it under a floor of iron plates on which can be prepared tar macadam or asphalt, or through a multitubular boiler, by which power may be produced to drive the machinery. The cells are designed to give the most perfect combustion to as large a quantity of refuse as possible with the least amount of labour; and with these objects in view a continuous supply of refuse to the fires will be effected by means of mechanical action applied to the fire-bars, and by the application of forced draught from a fan when necessary to increase the temperature. As soon as the flues leave the several blocks of furnaces, they will be dropped, so as to pass along below ground to the chimney. Proper access to the flues will be arranged to facilitate the removal of dust. A chimney, which will serve for the boilers as well as for the cells, is placed near the boiler-house; and it is proposed to carry it up from a concrete foundation 36 feet square to a height of about 200 feet above the yard-level.

It is proposed to provide 18 cells; and if their capacity is taken at 10 tons per cell per day, the depôt will be capable of disposing of 1080 tons of refuse during the week, and 60 tons would be burnt in the cells under the boilers on Sunday to keep the electric lighting going. This makes the capacity of the depôt 1140 tons per week, without involving any unnecessary Sunday labour. The total quantity of refuse collected in a summer week from the eight wards in which the parish is divided is 1336 tons; and in a winter week, 1669 tons. The quality of the refuse, however, being superior in winter, part of it might with advantage be burnt in the boiler furnaces; and in this manner, some of the surplus would be disposed of. The boilers could probably take 100 tons of refuse per week, using it only when a high rate of evaporation is not required, and resorting to coal when the heavy load comes on in connection with electric lighting. This arrangement would save £10 to £15 per week in coal and disposal of refuse by carting away.

Passing on to refer to the desirability of the Committee giving consideration to the expediency of carrying out another electric lighting station, or of increasing the plant at the present station, Messrs. Robinson and Blair say the following matters should be borne in mind: (1) The present station is only capable of serving 10,000 lamps simultaneously, or about 13,300 lamps installed; (2) at the present time there are about 11,000 lamps installed; (3) this demand has arisen in less than 18 months; and (4) a new station cannot be set to work in less than 18 months from the present time. The points to be decided are: Will the demand increase during the next 18 months to the extent of more than 2300 lamps, and is it desirable to extend the mains beyond the present limited area of supply? In the event of its being considered that an extension is desirable, the scheme presented in connection with the destructor works would, they think, meet the case in a most economical manner. The scheme provides for plant to serve 4800 lamps installed; thus bringing up the capacity of the Vestry's electricity generating plant to 18,100 lamps installed, or 13,600 lamps simultaneously in use, as against the present 10,000 lamps. The engine and boiler houses are designed to contain plant to serve double the number of lamps provided for at first; so that future extensions, as hereinafter indicated, can be carried out at any time rapidly and with great economy.

The estimated cost of erecting destructors, and the various works in connection therewith, is £17,270; but adding 10 per cent. for contingencies, the total is brought up to £19,000. The cost of disposing of the refuse is at present 3s. 9d. per ton, including collection. The cost of dealing with the same quantity at the depôt may be taken at 1s. per ton, to which may be added the cost of collection, estimated at 1s. 6d. per ton. This makes 2s. 6d. per ton, as compared with 3s. 9d. per ton at present, or a saving of 1s. 3d. per ton, which amounts to about £3700 per annum on the quantity of refuse dealt with at the depôt. There will also be a revenue of several hundred pounds per annum from mortar, &c., produced from the clinkers, and some small value in the clinkers themselves. After allowing for the instalment for interest and repayment of capital, and also for depreciation and maintenance of works, the reporters say there will remain a clear saving of £2000 to £2500 a year on the cost of refuse disposal only. The value of the heat utilized for electricity is estimated separately.

The following is the estimated cost of the first instalment of electric lighting works proposed to be carried out in connection with the destructors: Buildings, with contingencies, £5600; central station plant, do., £13,170; mains, do., £12,130—total, £30,900. The cost of completing the central station plant to serve 7500 lamps simultaneously, or 11,000 installed, would be £7600. The additional annual expenses of the electricity department in respect of the King's Road works will be as follows: Instalment for 3½ per cent. interest and repayment of loan in 42 years (4·6 per cent. on £30,900), £1420; maintenance and depreciation of new works, £1455; additional staff and miscellaneous fixed expenses, £1200—total amount of fixed expenses, £4075. In addition to this there will be variable expenses for water, oil, coal, &c., depending upon the output, and amounting to about ¼d. per unit. If the whole of the proposed plant is devoted to private lighting, about 4800 lights can be served. Assuming that the consumption will only be 37½ units per lamp per annum (the consumption in St. Pancras last year was 26 units per lamp in private houses, and 56 units in business premises, therefore the average will be upwards of 40 units if half the demand is in private houses),

the total output would be 180,000 units per annum, which, at the rate of 6d. per unit, would yield a revenue of £4500 per annum, while the expenses would be: Fixed charges (as above), £4075; variable expenses, 180,000 units, at ¼d., £187 10s.—total, £4262 10s. This shows a profit of upwards of £2200 a year; but as the day load for the whole district could be worked from King's Road with greater economy than from Stanhope Street, a further saving of several hundreds a year would accrue. Inasmuch as lamps for public lighting work for longer periods than private lights, a better result will be shown if a portion of the proposed plant were to be appropriated to work the 80 new arc lamps proposed as an extension of the present public lighting. If this were carried out, the number of private lights served would be reduced from 4800 to 3600. The output then would be: 80 arc lamps, using 2000 units, 160,000 units; 3600 incandescent lamps, using 37½ units, 135,000 units—total, 295,000 units. At 6d. per unit this would yield £7375 per annum; while the cost of production will be: Fixed charges (as above), £4075; variable expenses, 295,000 units, at ¼d. per unit, £307—total, £4382. This shows a profit of £3000 per annum, to which should be added (as before) the saving of several hundred pounds a year on the day supply. This £3000 a year could be devoted either to reducing the price to private consumers below 6d., and the charge for day current below 3d., or, as an alternative, to reduce the cost of street lighting. A much larger number of units could be generated at this station during the day and after midnight at a cost not exceeding ¼d. per unit. This power can be utilized for public lighting, for motive power during the day, and for charging batteries when the general demand is sufficient to warrant the erection of sub-stations. Day current could, therefore, be supplied at 2d. per unit with a large margin of profit.

In closing their report, Messrs. Robinson and Blair remark that a good reason for deferring for a few years the erection of sub-stations is that the manufacture of batteries is steadily undergoing improvement, in which a large field is still open; whereas there is very little room for improvement in central generating plant. The cost of maintenance and depreciation of batteries is also much greater than that of heavy low-tension mains, which may be used at first to serve longer distances than will be the case when customers are more numerous, and provision has to be made to supply the more distant parts from sub-stations. It is preferable, they say, to develop the electric lighting business in the manner indicated, than to introduce high-tension plant at the outset, with a view to reducing the size of the street mains, as it avoids the necessity for establishing sub-stations until there is a profitable amount of work for them to do, and it also to a large extent avoids the necessity for disturbing the streets a second time to enlarge or duplicate the distributing mains. It is actually the most economical system, because the first cost of the heavy low-tension mains is not greater than that of the smaller low-tension mains added to the cost of the high-tension primary mains and sub-station plant. The efficiency of direct distribution at low-tension, under these circumstances, is far higher than by high-tension with transformers, particularly at light loads.

SHEFFIELD CORPORATION WATER SUPPLY.

The Cost of the Work at the Damflask Reservoir.

At the Meeting of the Sheffield City Council last Wednesday, the minutes presented by the Water Committee contained a report on the work done in connection with the Damflask wing-trench, and asking for £24,129 to carry it on.

Mr. J. EATON suggested that, before any discussion took place, the Chairman of the Water Committee should explain what was meant by the proposal.

Alderman GAINSFORD said no doubt the work at Damflask was costing a great deal more money than was at first contemplated. So serious was the matter, that the Committee had met three times before putting the report on the minutes. The construction of a huge reservoir like that at Damflask—one of the largest in the country—was bound to be executed, if it was to be of any service whatever, with excessive care. After the dreadful experience they had 29 years ago in the Loxley Valley, there was no one who could wish any money or care to be spared to make the present work as efficient and safe as possible. The first estimate of the cost of the work was £13,882; another estimate prepared in 1890 or 1891, gave a total of £28,882; and this was increased to £53,000 by the sum they now proposed to borrow. These were extremely serious figures. The main reason for the increase in the estimate was that the size of the trench was larger than was originally intended. It was supposed that a water-tight foundation would have been found at a depth of 60 or 70 feet below the surface of the ground, and not more than half the length it had been since found necessary to go. They had had to excavate altogether considerably more than 100 feet; and the length of the trench was double what was originally intended. This was a point no one could have foreseen. As a consequence, the excavation required, instead of being 27,760 cubic yards, was more than 57,000 cubic yards. The quantity of concrete put in, instead of being 9260 cubic yards, turned out to be 16,355 cubic yards. The puddling, instead of being 18,500 cubic yards, was 35,305 cubic yards. In each case the quantities were about double those of the original estimate. Of course, as they went lower down, each 5 or 10 feet of work cost so much more, and the consequence was that the cost per cubic yard of the whole work was very much greater than was expected. The excavation, instead of being done at a cost of 5s. per cubic yard, was estimated to be done at not less than 6s. 6d. The concrete, estimated at 9s. per cubic yard, would cost at least 17s. 10d.; and the puddling, estimated to be done at 3s., would cost more than 7s. 3d. per cubic yard. These were enormous increases, due to the causes he had mentioned. The Committee were sure that Mr. Eaton, the Engineer, was giving an enormous amount of care to the work, and was entitled to their trust in regard to it. At the same time, the Committee had to look after the pockets of the ratepayers; and the difficulty they had was to draw the line rightly between interfering on the one side with the responsibility of the Engineer—because it was his responsibility—or allowing him too great a latitude, and to think that he had the unlimited purse of Sheffield to draw upon. Between these limits the Committee were doing their best to steer a proper course. The figures of the original estimate were made out in 1888 or 1889, and work carried out during the last two or three years had been at a considerably greater expense than might have been estimated in 1888 or 1889. The difficulty, too, of finding clay and stone for the work had been very much greater than was anticipated. Neither the Engineer nor the Committee in any way desired it to be understood that the £52,000 would finish the work. It was an undertaking of such a character that no one—not the best engineer in the world—could form an opinion of the ultimate cost.

The Council subsequently agreed to an application to the Local Government Board to approve of the borrowing of the £24,130 on capital account for the purpose stated.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

This week's budget of "Notes" is mostly made up of records of the annual meetings of Gas Companies and Corporations. The noticeable feature of the collection which is put forward to-day, is the almost universal step which is being taken of reducing the price of gas, and in most instances by large amounts.

The Arbroath Gas Commission held their annual meeting last Thursday, when the report by the Manager (Mr. R. S. Carlow) was submitted, as well as that of the Finance Committee. Mr. Carlow, in his report, stated that during the year 4824 tons of coal were carbonized, as against 4707 tons the previous year; that the yield of gas was 47,031,700 cubic feet, or an increased output of 561,200 cubic feet; that the yield per ton was 9754 cubic feet, or a decrease of 118 feet; and that the leakage amounted to 7·454 per cent., or a decrease of 0·8 per cent. on the preceding year. In submitting the Finance Committee's report, Mr. Cargill stated that their revenue from gas and meter rents amounted to £10,098, which was £153 more than in the preceding year. They had estimated the tar for the year at 6s. per 100 gallons, which was the price payable by Messrs. Dobbie. They had, however, only obtained 3s. 9d. per 100 gallons; and it was expected that, after they had received their final dividend from Messrs. Dobbie's estate, there would be a loss to them of £141 on the tar account. Their total income amounted to £11,083, as compared with £10,865 the previous year. On the other side, they had expended £5898 upon coal and lime, which was a decrease of £66; and the result was that there was a balance of profit amounting to £11 13s. 10d. remaining. Mr. Cargill expressed himself satisfied with this state of matters, explaining that the Government is entitled to half of the surplus made upon the gas undertaking for the year, and that they estimated for a small surplus. For the year which was now current, they proposed to reduce the price of gas from 4s. 7d. to 4s. 2d. per 1000 cubic feet. Their coal account was expected to amount to only £4401, and their lime account to £180; and they proposed to wipe off the loss upon Dobbie's tar account, bringing out an expected credit balance at the end of the current year of £15 12s. 5d. The reports were adopted. Mr. Michie, an outspoken member of the Commission, moved that reporters be admitted to all meetings of the Committee of Management; but the proposal was lost by eight votes to three.

At Alloa, where the Gas Commissioners are about to introduce the enrichment of coal gas with oil gas, the profit for the year was reported to have been £1430, as against £1429 last year. Provost Thomson, in presenting the accounts, stated that, while they could not show a large balance at their credit, they had been able to pay their way satisfactorily; and that, he thought, was more to be appreciated, seeing that during the last eighteen months there had been a considerable outlay in connection with the new gasholder and retort-bench, involving an expenditure of about £7000. They proposed to abolish the charge for meters, which would represent a loss of revenue of about £219 a year, and amounted to nearly 2d. per 1000 cubic feet of gas. They could not, therefore, see their way to reduce the price of gas this year. They were hopeful, he said, that the use of oil gas would result in a profit; but if they got no other advantage from it, they would certainly have gas of better illuminating power. The present price of gas is 3s. 4d. per 1000 cubic feet.

In the front rank of gas-supplying bodies in Scotland, may be reckoned the Dumfries Gas Commissioners. Last year their sale of gas amounted to 51,438,400 cubic feet, from which they derived £9001 of revenue. Their return from residuals amounted to £1165; and their total receipts, to £10,272. The result of the year's working was to bring out a balance of £1559; but after charges for interest on mortgages, temporary loans, and reserve fund were met, the result was that the balance of £735 at the credit of profit and loss account last year is reduced to £35. There was the unusually large amount of 11·50 per cent. of unaccounted-for gas; but this is stated to have been a slight reduction on the preceding year. Provost Scott said that in no year had they paid such high prices for coal; and it was very satisfactory to see the results they had obtained. The estimates for this year show an expected balance of profit of £142; and the price of gas is continued at 3s. 6d. per 1000 cubic feet. The Commissioners have purchased coal at about 2s. per ton less than last year, when the price was a little over 17s. 7d. per ton.

Provost Smith, of Peterhead, reporting to the Gas Commissioners at their annual meeting on Monday, stated that their total revenue had amounted to £4779, as compared with £4646 in the previous year. There was an increase of about £45 on the receipts from the sale of gas; but residuals fell from £337 to £284. On the expenditure side, coal cost £2025, as compared with £2227 in the preceding year. Their total expenditure was £3458, as against £3748; and the gross profit was £1230, as compared with £1031. The result of the year's operations was that, notwithstanding the abolition of £124 of meter-rents, and the placing of £464 to the sinking fund, there was a net profit of £42; and the adverse balance of £162 last year has now been

reduced to £130. The accounts were adopted. The Provost then read a letter from the Manager, Mr. John Mackay, stating that he had received an appointment in Edinburgh more lucrative than the one he held in Peterhead, and begging to resign his office. The Provost said he was sure the communication would be received with regret, because very few officials had ever succeeded so thoroughly in commending themselves to the confidence and respect of their employers as Mr. Mackay had done. Mr. Gray remarked that he regarded Mr. Mackay as a conspicuously able man, and never believed they would be able to retain him for a long time in their burgh. The resignation was accepted; and it was resolved to record in the minutes the Commissioners' regret at Mr. Mackay's resignation, their high appreciation of his services, and their good wishes for his future welfare. Arrangements were also made for the appointment of a successor.

The Gas Commissioners of Elgin report an income during the past year of £4844, which compares very favourably with an income the previous year of £4012. Of this amount, £4316 was derived from sales of gas; and the expenditure was £4546. The Commissioners resolved to reduce the price of gas from 5s. 5d. to 5s. per 1000 cubic feet, at which figure it stood two years ago. A gratifying remark was made by one of the members, to the effect that, since the improvements had taken place at the gas-works, he had a better light with one burner than he used to have with two.

The accounts of the Saltcoats Gas Company for the past financial year (to May 1) testify to the good progress made by the Company under the management of Mr. J. N. Myers. The Directors recommended an increase in the dividend from £5 to £6 13s. 4d. per share, as well as a reduction of 2½d. per 1000 cubic feet in the price of gas—making it 3s. 9d. Consumers and shareholders, therefore, both participate in the improved position of affairs; and Mr. Myers's share in bringing it about is recognized by an addition of £20 a year to his salary. This is all the more gratifying to the recipient as it was unsolicited by him, and the Directors were unanimous in granting it. The works are but small; but they turned out an additional 750,000 cubic feet of gas last year, while the leakage was reduced by 1 per cent. The total ordinary revenue was £2350 15s., or 4s. 2·64d. per 1000 cubic feet of gas paid for; the total ordinary expenditure was £1683 16s., or equal to 3s. 0·26d. per 1000 cubic feet. The total make of gas was 12,642,500 cubic feet (being 20,000 cubic feet more than the estimate), or 9476·78 cubic feet per ton of coal carbonized. Of the total production, 11,480,405 cubic feet, or 8605·67 cubic feet per ton, were used. Only two-thirds of the gas employed for public lighting is paid for; he rest is supplied free.

An installation of oil-gas plant for the working of Mr. Young's method of enrichment, was turned on in the works of the Kelso Gas Company about a fortnight ago, and has been found to give the utmost satisfaction. This is the second place after Peebles where it has been adopted. The Manager, Mr. F. Scott, reports that the gas being sent out averages 33-candle power. The happy inauguration of the oil-gas process was referred to by the Chairman at the annual meeting of the Company. He congratulated both the shareholders and the public upon the advantages they would derive from the use of the enriched gas. A dividend at the rate of 10 per cent. was declared; and, in view of the profit to be made out of the oil process, the Company reduced the price of gas from 5s. to 4s. 2d. per 1000 cubic feet.

Notice of the progress of a few other gas undertakings I must hold over till next week.

I am informed that the Peebles oil-gas process, though the patent has not yet been published, is already being worked at three different places in Scotland; that plant is in course of erection at seven other works; and that it has been all but decided to adopt it at a large number of other places, some of which are abroad.

The Crieff Gas Commissioners have raised the subject of the payment of way-leave by the Gas Company for the laying of pipes in the public streets. Recent instances have shown that where such charges are made, they cannot be resisted; but in this case the demand is out of the question, being for £30 a year. The Company decline to pay, on the ground that they have occupied the streets for more than 40 years without charge. If they are successful upon that, they will establish a "right of way" for pipes, which I do not think at present exists. It is stated that negotiations are proceeding; but that they have not been completed. That is the sensible way to look at the matter. Though the Company might be able to resist the claim for existing pipes, whenever they came to lay down new ones, the Commissioners would have it in their power to bother them; and if a small payment could get quit of that, it would be well expended.

A good illustration was given this week of the remarks before the Parliamentary Committee, to which I referred in my "Notes" last week, relating to the damage to gas-pipes in Motherwell by the subsidences of the ground owing to mineral workings. A resident in Hamilton, the town which adjoins Motherwell, on Tuesday morning called the attention of the Gas Manager to an offensive smell of gas in his house. The windows of the house had been left open all night; and a medical gentleman required to be called in to attend to one of the inmates, who was suffering from the effects of inhaling the gas. It was found that the service-pipe had been damaged. Opposite the adjoining house, the service-pipe was drawn out of its socket about 7 inches several weeks ago; and the Gas Commissioners have had a squad of men almost continually employed during the last six months looking after gas escapes caused by fractured pipes, arising from underground workings.

The Accrington Gas and Water Works Purchase Question.—A local correspondent writes: The news of the settlement of the dispute between the Accrington Gas and Water Company and the Local Authorities has been received with general satisfaction in the district. The terms of agreement require ratification by the shareholders of the Company on the one hand and the ratepayers of the five towns interested on the other; but this may be taken as a foregone conclusion. A strong feeling prevails among the ratepayers that the gas and water-works should belong to the people; and, once assured that the price agreed upon is fair and reasonable, the action of their representatives will be approved. In round figures, the amount will be £650,000.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 15.

Sulphate of Ammonia.—The recent quiet tone has passed away; and, in consequence of a good consumptive demand, it has been succeeded by a strong market, accentuated by "bull" operations of dealers who appear determined to force prices (for near delivery, at all events) to a higher level. This may not be difficult of accomplishment, seeing that the make is so very light at this season. The sales have been at £13 5s., Hull and Leith, with still buyers thereat. For delivery October-March, £12 5s., f.o.b. Leith, is asked. No business, however, is reported. Nitrate is steady, at 10s. per cwt. on spot.

LONDON, *July* 15.

Tar Products.—Values keep very low; and the demand generally, with the exception of that for tar acids, is very slack. The immediate future of benzols is discouraging; but it is felt that, if prices go much lower, other outlets than that of making anilines will present themselves. Distillers are much exercised about the high speculative price paid by a Midland manufacturer for a large Lancashire contract over a long period. The price paid will leave several shillings per ton loss at the present prices of products. Whether the future will recoup to-day's losses, is matter for doubt. Large sums of money have been lost in the past by this policy. To-day's prices may be taken as follows: Tar, 12s. 6d. Pitch, 23s. Benzols, 90's, 1s. 5d.; 50's, 1s. 4½d. Solvent naphtha, 1s. 0½d. Toluol, 1s. 5d. Crude benzol naphtha, 30 per cent., 7⅝d. Creosote, 1d. Creosote salts, 16s. Carbolic acid, 60's, 1s. 10d.; 70's, 2s. 2d.; crystals, 7d. Cresol, 1s. 8½d. Anthracene, nominal, 30 per cent. "A," 1s.; "B," 8d.

Sulphate of Ammonia.—Considerable business is being done at from £13 to £13 6s. 3d., less 3½ per cent. Makers' stocks are bare; and buyers are urgently pressing for material. The outlook for sulphate is excellent; and buyers and sellers are now agreed that prices will be maintained. Gas liquor is quoted at 8s. 6d. to 9s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The chief matter just now engaging attention in the coal trade of this district is, of course, the wages question; and that the proposed reduction of 25 per cent. will result in a strike on the part of the miners, is now regarded as practically certain. The men themselves, at the meetings which have so far been held, have expressed a strong determination to resist the reduction in wages; while the colliery-owners in not a few cases would be rather disappointed than otherwise if no stoppage took place, as the stocks generally held are heavier than has been the case for a considerable time past. So far the round coal trade has not been appreciably affected by the threatened strike; the only really increased pressure of demand which has come upon the market being for engine classes of fuel, which have been scarce for a considerable time past. Both the better qualities of round coal and the lower descriptions for steam and forge purposes are still hanging upon the market, with no really quotable advance in prices; although there has been, perhaps, more firmness, as sellers are less anxious about pushing off their surplus supplies. At the pit mouth, best Wigan Arley coal can still be readily bought at 11s. to 11s. 6d.; Pemberton four-feet and second qualities of Arley, at 8s. 6d. to 9s.; and lower qualities of round coal, at 6s. 6d. up to 7s. per ton. In engine classes of fuel, there has been a very general advance of 9d. to 1s. per ton; and in some instances special prices which are 2s. above those recently taken are being quoted. This upward movement has been brought about, partly by the previous scarcity of engine fuel, and partly by the anxiety on the part of consumers and millowners to get in extra supplies, in anticipation of the stoppage of the pits. In many cases, where engine fuel has not been obtainable, consumers have been buying through-and-through coal and furnace coal, the prices for which are still extremely low, in place of burgy and slack. At the pit mouth, good qualities of burgy are now readily fetching 7s.; best slack, 6s.; and lower descriptions, 4s. 6d. to 5s. per ton; with through-and-through coals obtainable at 6s. 6d. per ton. For shipping coal, no really better prices are obtainable, buyers seeming to be very dubious about the wages question resulting in the threatened strike; and to effect sales very low figures have still to be taken—steam coal not averaging more than 7s. 9d. to 8s. per ton, delivered at the Garston Docks or the High Level, Liverpool.

Northern Coal Trade.—There is decidedly a fuller demand for coal shown just now; but some of the gas companies and other large consumers have been taking larger quantities, so that their stocks are more ample to meet the needs, if the strike should take place in Yorkshire. Best Northumbrian steam coals have been sold once or twice at 9s. 6d. per ton f.o.b., and that is the price generally asked, though not as readily paid. For second-class steam coals, the demand is steady, but not pressing; and the price has scarcely increased as much as that for best steam. Small steam coals are 3s. 6d. per ton; and are rather more fully taken up. There has been a considerable addition to the inquiry for gas coals; but it has been readily met. Prices are firmer, though good Durham gas coals are obtainable at 6s. 3d. per ton f.o.b. The price varies from that up to 7s. 6d. per ton, which one or two collieries ask. Smithy coals are quoted at 8s. 6d. per ton. Blast-furnace coke is firm, with a good local demand, but with no scarcity. For export, best Durham coke is quoted at 14s. per ton f.o.b.; and the shipments have been considerable from the Tyne and West Hartlepool. In gas coke, there is now a slight increase in the output; but the demand is quickened, and stocks do not seem to increase so far. There is as yet no increase in the price of gas coke.

Scotch Coal Trade.—The improved demand mentioned last week has continued; but chiefly for shipping. In the West of Scotland, the holidays have now begun; and very little coal is required for public works, or will be till probably the end of next week. The labour element of the question has not developed further. The

prices quoted are: Main, 6s.; ell, 7s. to 7s. 6d.; splint, 7s. to 7s. 3d.; and steam, 7s. 9d. to 8s. 3d. per ton f.o.b. Glasgow. Shipments again show a decrease. The total for the week was 153,968 tons—a decrease of 2848 tons on the preceding six days, and of 5085 tons as compared with the corresponding week of last year. For the year to date, the total shipments have been 3,430,111 tons—a decrease of 378,391 tons, as compared with the same period of last year.

Exhibition of Gas Appliances at Guildford.—Under the auspices of the Guildford Gas Company, Messrs. Fletcher, Russell, and Co., Limited, held last week an exhibition of gas appliances in the County and Borough Halls, Guildford, with cookery lectures and demonstrations by Mrs. Wilkinson.

Sales of Shares.—On Monday last week, Messrs. Garrod, Turner, and Son sold by auction £2000 new "C" stock of the *Ipswich Gas Company*. The dividend paid on similar stock for the past three years has been at the rate of 8½ per cent. per annum; but, as the price of gas has now been reduced, the stock will be entitled to another ½ per cent., provided the profits allow of the higher rate being declared. The shares were put up in 200 single lots of £10 each; the Secretary and Manager (Mr. J. T. Jolliffe) purchasing the first ten at £18 15s. per share. The next five went at the same figure. An advance of 2s. 6d. per share was secured for the succeeding 24; and then the bidding settled down for a time at £18 15s. The lowest point touched was £18 12s. 6d.; prices afterwards going up to £18 17s. 6d., and closing at £19 for the last six shares.——At Great Harwood last week, some "B" stock of the *Accrington Gas and Water Company* was offered for sale by public auction. Eleven £10 shares were sold, after some spirited bidding, for £221; being at the rate of more than twice their par value.

The Hull Corporation and the Newington Water-Works.—A special meeting of the Hull Town Council was held on Monday last week to consider the minutes of the Water-Works Sub-Committee, which contained a proposition that the Corporation should purchase the undertaking of the Newington Water Company, with all their rights and powers, for an annuity of £3750, and a capital payment of £3000. The transfer is to take place on the 30th of September next; the Company receiving the income and discharging the liabilities up to that date. The annuity is to be redeemable at the expiration of 60 years, on the payment of £100,000. Mr. Wheatley, in moving the adoption of the minutes, said the reason he did so was because he believed the interests of the town would be served by the purchase. If the idea was to keep the works as a going concern, nobody, perhaps, would be inclined to find any great fault with the purchase; but there was no such understanding. It was intended, as soon as practicable, to close the works. It is considered that the best portion of the purchase is the mains, service-pipes, &c.; and as soon as may be after the end of September these will be used for conveying a supply of water to the inhabitants from Springhead. The Council approved of the recommendation of the Sub-Committee; and, almost without discussion, the minutes were adopted.

The Bolton Corporation and their Electric Lighting Scheme.—At the meeting of the Bolton Corporation on the 5th inst., the presentation of the minutes of the Gas Committee afforded an opportunity to Mr. Alderman Broughton to criticize the policy of the Council in adopting the alternating-current system of electric supply, instead of the continuous-current system, which they had previously decided upon. Alderman Miles, in reply, explained that their resident electrical engineer had been consulted, and, as the result, the report which led to the change of views was drawn up. In regard to the respective merits of the two systems which had been under consideration, he pointed out that less tension was needed for the alternating-current system, the cost of maintenance was less, and the system was a flexible one, and adapted for supplying scattered lighting which would be needed in Bolton. It was used in upwards of thirty English towns; so that they were going on lines which had been trodden before. The minutes were confirmed. At a meeting of the Gas Committee last Friday, the general conditions for the supply of electricity within the borough were approved of. The following are the rates to be charged: For above 12½ Board of Trade units, per 16-candle power lamp, 5½d. per unit; between 10 and 12½ units, 6d.; between 7½ and 10 units, 6½d.; between 5 and 7½ units, 7d.; between 2½ and 5 units, 7½d.; and below 2½ units, 8d. Customers using 650 units per quarter will be charged at the rate of 5d. per unit.

The Merthyr Board of Health and Messrs. Crawshay's Water Rights.—A great dispute which has now been in progress for some years between the Merthyr Board of Health and Messrs. Crawshay Bros., of Cyforthfa, respecting the water rights of the firm, is likely to be amicably settled. It appears that the parties really concerned are Messrs. Crawshay, the Glamorgan Canal Company, Hill's Plymouth Company, and the Board, although the litigation was really between the first and the last parties. The Board, however, would not enter into any agreement unless all were included. By the one now in draft, the Noyadd reservoir, or some other in substitution for it, is to be repaired or constructed before Dec. 31, 1897. The present site of the reservoir is to be considered as the base of the upper watershed. The whole of this the Board are to have absolute control over for the purpose of impounding by means of any number of reservoirs they may think necessary, subject to the stipulation that, when the reservoir contains 80 million gallons, 600,000 gallons per day shall be discharged into the stream, and be allowed to flow towards Pentwyn. When the reservoir contains more than 80 million, and not more than 100 million gallons, the discharge of compensation water is to be 700,000 gallons; when the storeage is more than 100 million, and less than 120 million gallons, it is to be 800,000 gallons; if the storeage be more than 120 million, and not more than 140 million gallons, it is to be 900,000 gallons; and if the reservoir contains 140 million gallons, the discharge is to be 1 million gallons. Until the reconstruction of Noyadd reservoir, or the making of a fresh one, the Board are to have power to intercept, by their existing Noyadd reservoir and their service-pipes therefrom, such water as they require for their district. The action commenced by Messrs. Crawshay against the Board is to be discontinued, and parties will pay their own costs.

Additional Storeage at the Ulverston Gas-Works.—Messrs. R. Dempster and Sons, Limited, of Elland, have just completed the erection of a telescopic gasholder 80 feet in diameter, each lift 20 feet deep, and the framing consisting of ten wrought-iron standards and two rows of girders, for the Ulverston Local Board, in accordance with designs prepared by the Gas Engineer (Mr. J. Swan).

Electric Lighting Tenders for Liege.—The Municipal Council of Liége recently had before them six tenders for the electric lighting of the town. The competing firms were MM. Van Rysselberghe and Moris, of Antwerp; Messrs. Siemens and Halske, of Berlin; M. Pieper, of Liége; and M. Jasper, of Liége. The concession includes the sole right to establish overhead or underground conductors, with the exception of those intended for use in connection with electric traction. For the present it is only intended to light a portion of the town. The tenders varied in amount from £20,000 to £52,000 for the installation work, and from 5d. to 7d. per kilowatt in the charge for the supply of the current. Owing to diversity of the amounts submitted, no decision was arrived at.

Completion of the Transfer of the Stourbridge Gas-Works to the Improvement Commissioners.—At a special meeting of the Stourbridge Improvement Commissioners last Tuesday, the Gas Committee presented a report, in the course of which it was stated that the purchase of the gas undertaking by the Board had been completed on the 4th inst., except that the costs of the Gas Company had still to be taxed, and another matter disposed of connected with the purchase. The Board were asked to empower the Committee to settle the business, in accordance with the finding of Messrs. Alfred Lass, Wood, and Co. Arrangements were in progress for taxing the costs of the Company in the arbitration. The report was adopted. It was ordered that a cheque for £574, on loan account in connection with the purchase of the gas undertaking, should be drawn in respect to the extension of the works.

Fatality during Well-Boring Operations.—A loss of four lives is reported from Shanklin; the deceased being Mr. T. Parsons, the inventor of a patent boring-machine, of St. Helen's, Isle of Wight, his son, Edward Parsons, and two workmen, named Harry Simkins and Edward Blake, both of Godshill. The three latter were engaged last Wednesday in boring for water for the Shanklin Local Board. They did not return, and at midnight Mr. T. Parsons, who was the contractor for the job, went to the boring works in search of them. Stepping down to a landing near the top of a well, forming the focus of the boring operations, he fell into the water below and was drowned. The police went in search of him, and found all four men dead. Blake was hanging by his legs from a staging. It is thought that all of them were overcome by noxious gases suddenly escaping from the boring-tube, which had pierced a depth of upwards of 200 feet.

The Buenos Ayres Water Supply and Drainage Company, Limited.—The Liquidators of this Company have issued a circular, in the course of which they state that the result of certain arrangements made by them and by the other parties interested is that, after satisfying the claims of the holders of debenture scrip, in accordance with the scheme approved by the Court of Chancery, and after adjusting and settling all accounts with the contractors and all other claims upon the assets of the Company, with the exception of one, for which provision has been otherwise made, there will remain available for division among the holders of the £3,000,000 preference shares of the Company, bonds of the nominal value of £3,000,000, together with funding loan bonds representing one year's interest from July 1, 1892, to June 30, 1893. The necessary arrangements are being made for the immediate distribution of these bonds and scrip certificates for fractional proportions.

Ashbourne Water Supply.—At the monthly meeting of the Ashbourne Local Board on Monday last week, the Chairman (Mr. J. Osborne) read a report from the Water Committee, respecting an additional water supply, and recommending the Board to undertake the work as soon as practicable. The Committee further recommended the Shepherd's Folly Spring, which had been examined by Mr. Radford, as being the best scheme. It was estimated that the total outlay would be about £6500. Mr. Radford's estimate of the cost of the work was £5300; and other expenses and extras, £325. This spring had been tested, and would in 24 hours yield 150,000 gallons of water, which was reported to be of exceptionally good quality. If all the houses in the Local Board's district took the water, the consumption would be about 60,000 gallons per day. It was resolved that the report should be adopted, and also that the opinion of the town should be taken before anything further was done.

West's Stoking Machinery and Regenerator Furnaces.—The Gas Committee of the Manchester Corporation have decided to introduce mechanical stoking into the new retort-house at their Bradford Road station; and they have instructed West's Gas Improvement Company, Limited, to supply them with their new compressed air machinery, similar to that furnished to the Old Kent Road works of the South Metropolitan Gas Company, the Saltley works of the Birmingham Corporation, and the Sydney (N.S.W.) Gas-Works. The retort-house being 360 feet long, the installation will necessarily be on an extensive scale—requiring four drawing and four charging machines. One of the chief features of the latter is that they can deposit 8 cwt. of coal in each 20 feet through retort, and even more, if there is sufficient heat to carbonize it, without entailing any extra work on the driver. The motive power for these machines is derived from a compound two-stage air compressor, specially designed and manufactured by the Company for this class of machinery, the efficiency of which has been severely tested by Professor Goodman, of the Yorkshire College, Leeds, who has expressed a very high opinion as to its economy. This will be the largest installation of stoking, coal-breaking, and hauling machinery in the North of England. The Plymouth and Stonehouse Gas Company have also decided to adopt the same kind of stoking machinery in their new retort-house in course of erection, together with elevating and conveying machinery for taking the coals from the stores to the house, which is also to be fitted with West's regenerator furnaces. The whole of this work has been entrusted to West's Gas Improvement Company.

The Wakefield Union and the Water Supply of the Outlying Districts.—A Select Committee of the House of Commons, presided over by Mr. A. de Tatton Egerton, have lately held an inquiry into a Bill to confirm a Provisional Order of the Local Government Board authorizing the Wakefield Union authorities to acquire lands for water supply and sewage disposal for the contributory places of East and West Ardsley, Crigglestone, Stanley-cum-Wrenthorpe, Alverthorpe, and Thornes. In the course of a discussion, it turned out that the main point of difference was whether an easement of the Corporation for their water-pipes under an occupation road and public footpath in the parish of Batley would be interfered with; Mr. Balfour Browne, Q.C., urging that there was room to lay the pipes without touching the Corporation's easement. Ultimately, an agreement was arrived at between the parties; the Union undertaking not to bring their pipes within 6 feet of the Corporation's pipes without the consent of the Engineer. Any matter in difference between the Engineers of the two bodies in relation to the manner in which the works were to be carried out, the Committee decided should be referred to an independent engineer, to be appointed by the Board of Trade. The Bill then passed the Committee.

Dublin Water Supply.—At the meeting of the Dublin Municipal Council on Monday last week, attention was called to the great waste of water in the city. Mr. Walker, referring to the exceptionally dry weather of the present year, said it commenced as it did in 1887, on the 1st of March; but it had been more continuous this year. On March 1, 1887, the water in the Roundwood reservoir was level with the overflow sill; it continued gradually to decrease until Nov. 1 in that year, when it had fallen 27 feet. On July 6, 1887, the water in the reservoir had fallen 9·2 feet below its normal height. On July 6 of the present year, the water had fallen 11·7 feet. This meant that there were in the reservoir 224 million gallons of water less than at the corresponding period in the driest year they had known. For all practical purposes, their Engineer stated, the reservoir was more than half empty. There was now in Dublin, and continued to be, a great waste of water, not only amongst those who used it for domestic purposes, but by those who took the Vartry water for manufacturing purposes. In some of the townships, there was considerable waste. If the dry season continued up to the 1st of November next, the citizens of Dublin and the inhabitants of the different townships would be subject to a water famine. Directions were given to communicate with all the townships and superintendents of corporate departments having control over the water consumption, to give the matter earnest attention.

The Effect of the Drought on the Manchester Water Reservoirs.—On the afternoon of the 8th inst., a large number of members of the Ancoats Brotherhood visited the Manchester Water-Works in the Longdendale Valley. The party was led by Mr. Alderman Hoy, who is a member of the Water Committee. The effects of the long drought were made evident during the afternoon. At the Woodhead reservoir, the visitors were informed that the water was no less than 47 feet below the top level; while the water at Torside was down by 40 feet. At these reservoirs, however, it is usual to keep the water lower than the top level, in order that they may receive the floods which sometimes come with little warning. At the three lower reservoirs of Rhodes Wood, Vale House, and Bottoms, the stock was not so seriously reduced. Mr. Alderman Hoy made some general explanations, which were listened to with a great deal of interest. Woodhead, he pointed out, was the extreme head of the Manchester supply, and the little river which had its rise there—the Etherow—was really the beginning of the Mersey. The Woodhead reservoir was used for compensation purposes; supplying the mills and manufacturers on the river below to the extent of 13 million gallons a day. The Torside and Rhodes Wood reservoirs were used for the purposes of the Manchester supply; while the Vale House and Bottoms reservoirs were devoted to the same object as Woodhead. After these explanations, the party visited one after another the five reservoirs referred to.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 121.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Apl.	10½	Alliance & Dublin 10 p. c.	10	15½—17½	..	6 0 0
100,000	10	„	7½	Do. 7 p. c.	10	11½—12½	..	6 0 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	102—104	..	4 16 2
100,000	20	31 May	3	Bahia, Limited	20	10½—11½	..	13 18 3
200,000	5	12 May	6¼	Bombay, Limited	5	5½—6	..	5 8 4
40,000	5	„	6¼	Do. New	4	3½—4½	..	6 2 6
380,000	Stck.	24 Feb.	11½	Brentford Consolidated	100	222—227	..	5 1 4
180,000	„	„	8½	Do. New	100	168—173	..	4 18 3
220,000	20	15 Mar.	11½	Brighton & Hove Original	20	41—43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	104—107	..	4 13 5
320,000	20	13 Apl.	11½	British	20	42—44	..	5 4 7
50,000	10	15 Mar.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	„	8½	Do. 7 p. c.	10	15—16	..	5 6 3
328,750	10	—	—	Buenos Ayres (New) Limited	10	6½—6¾	..	—
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	97—100	..	6 0 0
150,000	20	13 July	8	Cagliari, Limited	20	25—27*	+1	5 18 6
550,000	Stck.	28 Apl.	12½	Commercial, Old Stock	100	243—248	—2	5 0 10
165,000	„	„	9½	Do. New do.	100	182—187	..	5 1 7
160,762	„	15 June	4½	Do. 4½ p. c. Deb. do.	100	125—130	..	3 9 3
800,000	Stck.	15 June	13	Continental Union, Limited	100	227—232	..	5 12 0
200,000	„	„	10	Do. 7 p. c. Pref.	100	190—195	..	5 2 7
75,000	Stck.	15 Mar.	10	Crystal Palace District	100	190—195	..	5 2 7
486,000	10	27 Jan.	10	European, Limited	10	21½—22¾	..	4 8 11
354,060	10	„	10	Do. Partly paid	7½	15—16	..	4 13 9
5,596,560	Stck.	10 Feb.	12	Gaslight & Coke, A, Ordinary	100	225—230	+1	5 4 3
100,000	„	„	4	Do. B, 4 p. c. max.	100	95—99	..	4 0 10
665,000	„	„	10	Do. C, D, & E, 10 p.c. Pf.	100	263—268	..	3 14 7
30,000	„	„	5	Do. F, 5 p. c. Prf.	100	120—125	..	4 0 0
60,000	„	„	7½	Do. G, 7½ p. c. do.	100	175—180	..	4 3 4
1,300,000	„	„	7	Do. H, 7 p. c. max.	100	170—175	..	4 0 0
463,000	„	„	10	Do. J, 10 p. c. Prf.	100	262—267	..	3 14 10
476,000	„	„	6	Do. K, 6 p. c. Prf.	100	157—162	+1½	3 14 1
1,061,150	„	15 June	4	Do. 4 p. c. Deb. Stk.	100	125—128	..	3 2 6
294,850	„	„	4½	Do. 4½ p. c. do.	100	128—132	..	3 8 2
908,000	„	„	6	Do. 6 p. c. do	100	170—175	+3	3 8 8
3,800,000	Stck.	12 May	12	Imperial Continental	100	220—225	—2	5 6 8
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	5—5½	..	5 9 1
560,000	100	4 Apl.	5	Met. of Melbourne, 5p. c. Deb.	100	103—105	..	4 15 3
541,920	20	15 June	5	Monte Video, Limited	20	13—14	..	7 2 10
150,000	5	31 May	10	Oriental, Limited	5	7½—8	..	6 5 0
60,000	5	29 Mar.	7	Ottoman, Limited	5	4½—4¾	..	7 3 8
166,870	10	—	2	Pará Limited	10	2—2½	..	—
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	100—105	..	5 14 3
500,000	100	1 June	6	2nd Do.	100	98—102	..	5 17 8
150,000	10	28 Apl.	5	San Paulo, Limited	10	8½—9½	..	5 5 3
500,000	Stck.	24 Feb.	15½	South Metropolitan, A Stock	100	297—302	..	5 2 8
1,350,000	„	„	12	Do. B do.	100	244—248	..	4 16 9
230,000	„	„	13	Do. C do.	100	250—255	..	5 1 11
750,000	„	13 July	5	Do. 5 p. c. Deb. Stk.	100	147-151*	+1½	3 6 2
60,000	Stck.	15 Mar.	11½	Tottenham & Edm'nton, "A"	100	215—220	..	5 4 6
				WATER COMPANIES.				
744,897	Stck.	29 June	10	Chelsea, Ordinary	100	257—262	..	3 16 3
1,720,252	Stck.	29 Mar.	8	East London, Ordinary	100	203—208	—1	3 16 11
544,440	„	29 June	4½	Do. 4½ p. c. Deb. Stk.	100	140—143	..	3 2 11
700,000	50	15 June	8½	Grand Junction	50	107—110	..	3 17 2
708,000	Stck.	10 Feb.	11	Kent	100	280—285	..	3 17 2
1,043,800	100	29 June	9½	Lambeth, 10 p. c. max.	100	233—238	+1	3 19 10
406,200	100	„	7½	Do. 7½ p. c. max.	100	195—200	..	3 15 0
310,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	129—132	..	3 0 7
500,000	100	10 Feb.	12½	New River, New Shares	100	329—334	..	3 12 8
1,000,000	Stck.	27 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—137	..	2 18 5
902,300	Stck.	15 June	6	S'thwk & V'xhall, 10 p. c. max.	100	147—152	..	3 18 10
126,500	100	„	6	Do. D 7½ p. c. do.	100	140—145	..	4 2 9
1,155,066	Stck.	15 June	10	West Middlesex	100	253—258	..	3 17 6

*Ex Div

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON." **GWYNNE & CO.,** TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

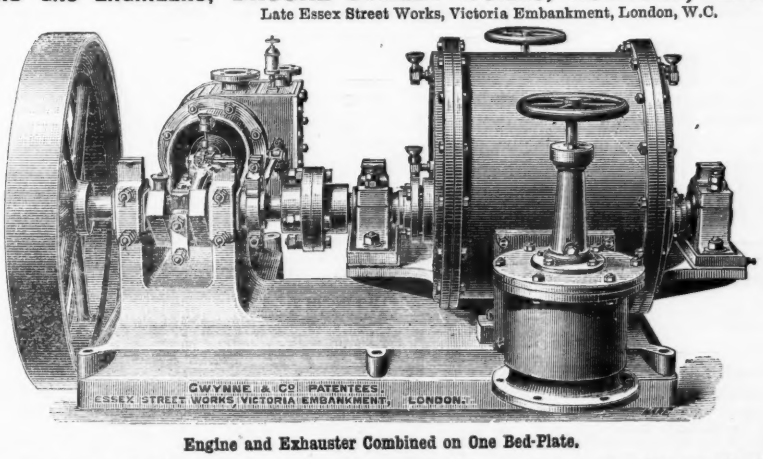
Late Essex Street Works, Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



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Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

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Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
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JOHN WM. O'NEILL, Managing Director.

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ROBERT BRUCE FITZMAURICE, 29, Great St. Helens, London, Shipping Agent to several Gas Companies and Plant Manufacturers, would be glad to UNDERTAKE LARGE or SMALL SHIPMENTS to any Port.

SITUATION wanted as Boiler Stoker. Eighteen Months' experience. Moderate wages. Aged 24.
Apply, F. S., 66, Foord Road, Folkestone, KENT.

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Highest References from leading Gas Engineers.
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WANTED, an Experienced Man to take charge of the Peterhead Corporation Gas-Works. He must possess an intimate knowledge practically and theoretically of the Manufacture of Gas, on the most modern principles. He will also require to act as Secretary and Inspector of Lighting. The duties will be ascertained on application to the Town Clerk. The Works at present carbonize 1800 tons per annum. Salary, about £120.
Applications, with copies of three recent testimonials, to be sent to the Town Clerk, Peterhead, on or before the 1st of August next.
Peterhead, July 11, 1893.

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*** See Advertisement p. II., centre of JOURNAL.
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Candidates must not exceed 30 years of age; and must have had experience in the Manufacture of Gas-Meters, and also in Gas-Meter Testing under the Sales of Gas Act, 1859, in an official testing-station. Salary, £100 per annum, increasing £10 per annum, until it reaches £120 per annum, subject to a contribution of not exceeding 5 per cent. per annum to the Superannuation Fund and to the statutory superannuation provisions for the time being in force in the city. The person appointed will have to devote the whole of his time to the duties of his office; and the engagement will be determinable by one calendar month's notice, to expire on the last day of any calendar month.
Applications, in the candidate's own handwriting, stating age, qualifications, and previous engagements, accompanied by copies of not more than three recent testimonials, endorsed "Assistant Gas-Meter Inspector," and addressed to the Chairman of the Watch Committee, under cover to the City Engineer, Municipal Offices, Liverpool, must be delivered at the City Engineer's Office not later than Twelve o'clock noon, on Saturday, the 29th of July, 1893.
Canvassing prohibited.
By order,
GEORGE J. ATKINSON,
Town Clerk.
Municipal Offices, Liverpool,
July 10, 1893.

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WANTED, two 12-inch, four 15-inch, and four 18-inch GAS-VALVES.
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EXHAUSTER (Rotary), perfectly New (Makers, Dempster and Sons), 20,000 cubic feet per hour, ON SALE, cheap.
Apply to T. G. MARSH, 41, Corporation Street, MANCHESTER.

FOR SALE—A Set of Two Second-Hand PURIFIERS, each 12 feet by 8 feet by 4 feet deep made in Plates having 12-inch Lutes, and Wrought-Iron Covers, together with 10-inch Hydraulic Valves and Connections, and Lifting Apparatus. Both in good condition.
For further Particulars apply to THOMAS TURNER, Manager, Gas-Works, AIRDRIE, N.B.

FOR SALE—One volume of the "GAS AND WATER TIMES," 1853 to 1855; One volume (Sundries) "JOURNAL OF GAS LIGHTING," 1852 to 1862; Forty volumes of "JOURNAL OF GAS LIGHTING," from 1861 to 1887—all bound, and numbers from 1887 up to present date unbound.
Offers to E. H., 3, Hemberton Road, CLAPHAM.

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TO be Sold or Let, with immediate possession, either the whole or part of the Premises, containing 58,127 square yards, with the following Buildings thereon—viz., One 379 feet by 112 feet; two each 299 feet by 56 feet; two each 115 ft. 6 in. by 56 ft. 6 in.; and one 224 feet by 126 feet. The Premises, which are well adapted for the erection of large gasholders and gas plant, are situate in close proximity to the New Dock, and have direct railway communication therewith, as also with the London and North-Western and L. & Y. Railways, by means of a railway running into the works.
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FOR SALE—Two perfectly new Cast- Iron SCRUBBERS, 10 feet diameter by 50 feet high, with Wrought-Iron Domes, Cast-Iron Spiral Staircase, &c., complete. All plates machine planed. One or both Scrubbers will be sold to suit purchasers.
A perfectly new 30,000 per hour HORIZONTAL DOUBLE PUMP RECIPROCATING EXHAUSTER, with Steam-Engine, with Connections and Valves.
One Second-hand (thoroughly overhauled) VERTICAL PUMP EXHAUSTER, with Steam-Engine (with clean Water and Liquor Pumps attached), to pass 7000 cubic feet of Gas per hour.
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The whole of the above Plant can be inspected, and full particulars with prices will be sent, on application to No. 2241, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE, the following second-hand GAS PLANT:—
GASHOLDER, 35 ft. by 14 ft.
GASHOLDER and Cast-Iron TANK, 30 ft. by 17 ft.
Four PURIFIERS, 12 ft. square by 4 ft. 6 in. deep.
Cast-Iron SCRUBBER, 36 ft. high by 10 ft. diameter.
CONDENSERS to pass 500,000 cubic feet per diem.
EXHAUSTER to pass 20,000 cubic feet per hour.
Also various other sizes of above or any Gas Plant. Inquiries invited.
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TO GASHOLDER MAKERS.

THE Owners of West Stanley Colliery are prepared to receive TENDERS for the construction of a GASHOLDER and WROUGHT-IRON TANK.
Plan and Specification may be seen at the Office, 6, King Street, Newcastle-on-Tyne.
Sealed tenders to be delivered on or before the 31st of July, 1893.
The Owners do not bind themselves to accept the lowest or any tender.

MORECAMBE GAS AND LIGHT COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for the supply of 3500 tons of GAS COAL, to be delivered on the Gas-Works Siding, Midland Railway, Morecambe, in such quantities as may be required during the Year.
Tenders, specifying the description of the Coal, the name of the pit at which it is raised, and the terms for net monthly payment, are to be sent on or before Monday, the 24th of July, 1893, endorsed "Tender for Coal."

WILLIAM DUFF,
Secretary and Manager.
Market Street, Morecambe,
July 7, 1893.

TENDERS FOR TAR.

THE Directors of the Exeter Gaslight and Coke Company invite TENDERS for their surplus TAR for One Year, from the 14th day of October next.
Delivery on Company's Works, filled into Purchaser's Tanks or in Barges alongside Works.
Payment, cash monthly.
Sealed tenders, endorsed "Tender for Tar," will be received by the undersigned on or before Thursday, the 31st of August next; but the Directors do not bind themselves to accept the highest or any tender.

By order,
W. A. PADFIELD,
Secretary.

SUTTON-IN-ASHFIELD LOCAL BOARD.
(GAS DEPARTMENT.)

SUPPLY OF GAS COAL.

THE Gas Committee of the above Local Board are prepared to receive TENDERS for the supply of 2400 tons of well-screened GAS COAL, to be free from Shale and Pyrites, and to be delivered at the Railway Town Station, Sutton, in such quantities as the Manager shall from time to time direct, between Sept. 1, 1893 and June 30, 1894.
Particulars may be obtained on application to Mr. A. Clarke, Gas-Works, Sutton-in-Ashfield, Notts.
Tenders, stating Price, to be addressed to Mr. A. Clarke, Gas-Works, Sutton-in-Ashfield, and marked "Tender for Coal," so as to arrive not later than Tuesday, the 2nd of August, 1893.

By order,
G. H. HIBBERT,
Clerk to the Committee.
Local Board Offices, Sutton-in-Ashfield, Notts.

UXBRIDGE AND HILLINGDON GAS CONSUMERS' COMPANY.

TO TAR DISTILLERS.

THE Directors are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works during the ensuing Twelve Months from the 1st of September next.
The quantity will be about 33,000 gallons, and will be delivered free into the Contractor's Barges alongside the Works, on the Grand Junction Canal.
Tenders, endorsed "For Tar," and addressed to the Chairman, must reach the Gas Company's Offices, High Street, not later than Saturday evening, Aug. 5.
The Directors have no special Form of Tender; and do not bind themselves to accept the highest or any tender.
Further and all particulars may be obtained of the undersigned.

S. PENNY, Assoc.M.Inst.C.E.,
Engineer and Manager.
Uxbridge, Middlesex,
July 17, 1893.

CONTRACT FOR GAS COAL.

NOTICE is hereby given, that the Local Board for the District of the town of Horncastle, in the County of Lincoln, are prepared to receive TENDERS for the supply of from 500 to 1800 tons (Railway weight) of best screened SILKSTONE GAS NUTS, to be delivered by the 30th of June, 1894, in such quantities and at such times as the Board may direct.
The Coal to be sent in a dry condition, free from hards, smudge, dirt, shale, pyrites, or other impurities.
Sealed tenders, marked "Tender for Gas Coal," to be sent to the Chairman of the Board, Mr. John Panton, High Street, Horncastle, on or before the 29th day of July, 1893.
The Board do not bind themselves to accept the lowest or any tender.

By order,
CHARLES DEE,
Clerk to the Board.
Horncastle, July 18, 1893.

HARTLEPOOL GAS AND WATER COMPANY.

IMPORTANT SALE OF SHARES.

TO be Sold by Auction, at the "Royal" Hotel, West Hartlepool, on Thursday, the 27th day of July, 1893, at three o'clock in the afternoon precisely —JOHN W. CROSBY, Auctioneer—200 SHARES of £10 each (Maximum Dividend limited to 7 per cent. per annum), being part of the Gas Capital authorized to be issued by the Hartlepool Gas and Water Act, 1878, and required by Section 9 of that Act to be offered to the public for sale by Auction.
The above Shares will be entitled to Dividend from the 28th day of August next, and to be registered in the name of the purchaser without charge.
A Deposit of 10 per cent. will be required to be paid at the time of sale; the remainder to be paid on or before the said 28th day of August.
The Shares will be sold in lots of ten each.

By order of the Directors,
THOMAS TREWHITT,
Secretary.
Hartlepool Gas and Water Company's Office,
West Hartlepool, June 8, 1893.

BRISTOL WATER-WORKS COMPANY,
ORDINARY STOCK.

ALEXANDER, DANIEL, SELFE, & CO. will sell BY AUCTION, at the Bank Auction Mart, Corn Street, Bristol, on Thursday, the 27th day of July, 1893, at Two o'clock in the Afternoon,
£20,000 BRISTOL WATER-WORKS SEVEN PER CENT. MAXIMUM ORDINARY STOCK,
which will be offered in convenient Lots of £100 Stock and upwards, at the reserved price of £137.
The above £20,000 Stock is part of 7 per Cent. Maximum Ordinary Stock, amounting to £240,000, created under the powers of the Bristol Water-Works Act, 1888.
The Dividend is subject to proportionate diminution whenever the Maximum Dividend to which each class of Ordinary Shares or Ordinary Stock of the Company is entitled shall not be paid in full; but such diminution may be made up in subsequent years.
The Dividend on this Stock for 1891 and 1892, was £5 5s. per cent. per annum, at which rate of Dividend Stock purchased at £137 per £100 Stock would yield £3 16s. 7d. per cent. per annum.
For further Particulars and Conditions of Sale apply to the AUCTIONEERS, Bank Chambers, Corn Street, BRISTOL (and 34, Old Jewry, LONDON, E.C.); to Messrs. FUSSELL & Co., Solicitors, 36, Corn Street, BRISTOL; or the GENERAL MANAGER, Bristol Water-Works Office, Small Street, BRISTOL.

Price 2s. per dozen, or 10s. 6d. per 100, post free.

CONSPIRACY and Protection of Property Act. It is required, under a Penalty of FIVE POUNDS, that a Printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat.
Printed copies of this Section, in large type, on broad sheets, may be obtained of WALTER KING, 11 Bolt Court, FLEET STREET, E.C.

*** *The Act extends to Scotland and Ireland.*

MEIKLEJOHN'S PATENT
Improved Slide-Valve Anti-Dip.
Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.
Is cheap and easily fixed to any form of main.
Will be found the most efficient appliance of the kind yet introduced.
Further particulars and price from
C. MEIKLEJOHN,
GAS-WORKS, RUGBY.
(Late N. MEIKLEJOHN, Longwood.)

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production over 3200 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* **gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of over**
400,000 Tons per Annum.

Full particulars on application to
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

COKE BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT.)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.
For Exhauster Advertisement, see last week.
GEORGE WALLER & CO.,
PARK STREET, SOUTHWARK, E.C.,
And at STROUD, GLOUCESTERSHIRE.

NIDDRIE CANNEL
A FIRST-CLASS CANNEL COAL,
Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.
FOR ANALYSIS, PRICE, AND ALL OTHER PARTICULARS, APPLY TO
The Niddrie & Benhar Coal Co., Ltd.,
15, HANOVER STREET,
EDINBURGH.
Telegrams: "BENHAR, Edinburgh."

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.
FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

Shipments Promptly and Carefully Executed.

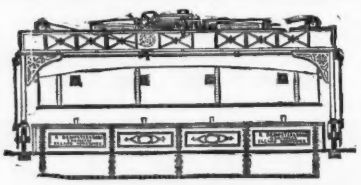
ROBERT MARSHALL,

CANNEL COAL MERCHANT

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

DEMPSTERS'



PURIFIERS (MACHINED JOINTS).

PURIFIERS.

ELLAND.

BRISTOL (AVON ST.) GAS-WORKS.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI, LONDON, W.C.

For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**

ADDRESS

JAMES WHITE & Co., Limited,

ALBERT WORKS, WIDNES.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

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Telegrams: "HUNTER PORT GLASGOW."

Established 1872.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,

Output about 3000 tons per day.

ANALYSIS—		
Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON,

FITTER.

AUG. KLÖNNE,

DORTMUND (GERMANY).

REGENERATIVE FURNACES.

Unsurpassed in Efficiency, Economy, Durability, and Easy Working.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY

Strongly recommended where EXCESSIVE HEATS have to be maintained.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.

Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The

WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.

Yield of Coke: 13½ cwt.

Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**

The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

FAMOUS LEESWOOD

"CURLEY CANNEL."

YIELD: 15,306 CUB. FT. PER TON OF 30·62-CANDLE POWER.

SMOOTH CANNEL.

YIELD: 12,321 CUB. FT. PER TON OF 21·321-CANDLE POWER.

PRICES AND PARTICULARS OF

MESSRS. S. CHANDLER & SONS,

LEESWOOD COAL AND CANNEL MINES,

PONTYBODKIN, nr. MOLD, NORTH WALES.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS "PIPES GLASGOW."

WM. MACLEOD & CO.,

56. ROBERTSON STREET, GLASGOW.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

TUBES AND FITTINGS

TRADE MARK.

JOHN BROTHERTON & Co.

LIMITED.

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IMPERIAL TUBE WORKS, WOLVERHAMPTON.

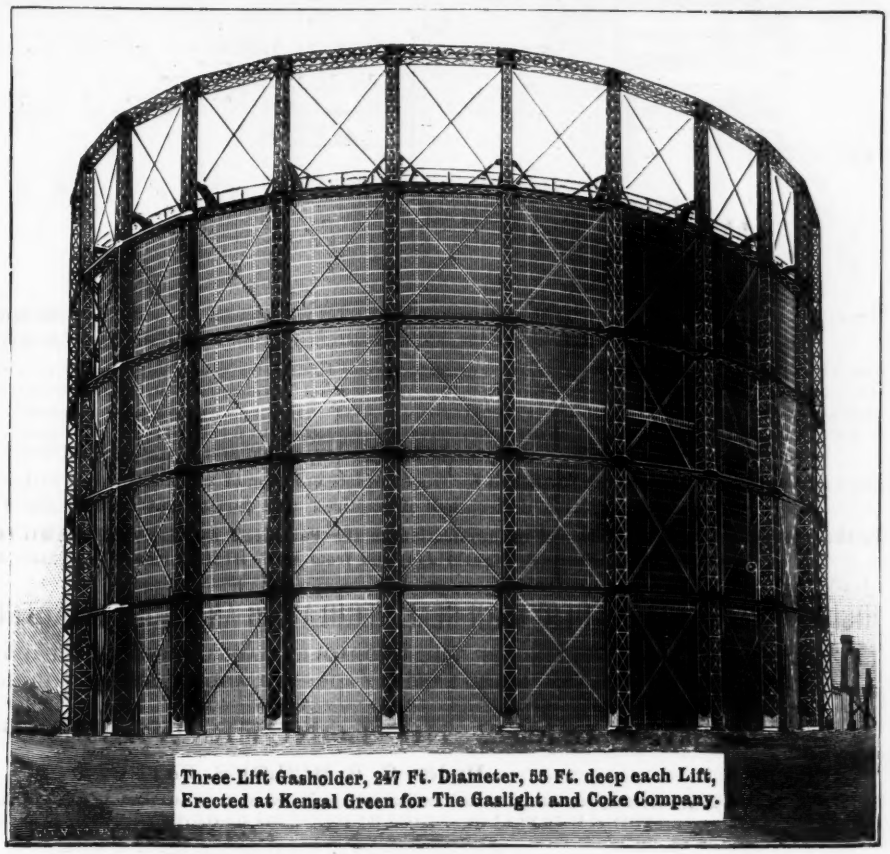
SAML. CUTLER & SONS. MILLWALL, LONDON.

NEARLY

8 MILLION

CUBIC FEET

CAPACITY.



Three-Lift Gasholder, 247 Ft. Diameter, 55 Ft. deep each Lift, Erected at Kensal Green for The Gaslight and Coke Company.

JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of

ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.

Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.

Telegrams: "ATLAS SHEFFIELD."

WILLEY & Co.,

Gas Engineering Works, Commercial Road, Exeter,

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS.

GASHOLDERS, Telescope and Single Lift, any size. Some of the largest in the Kingdom, erected by this Firm, are giving the highest satisfaction.

PLANS and SPECIFICATIONS furnished for **Extensions** and **Enlargement** of existing **Works,** adapting them to the most **Improved** and **Modern Principle** of **Gas Manufacture.**

PURIFIERS, CONDENSERS, WASHERS, ENGINES and EXHAUSTERS, STATION METERS and GOVERNORS, manufactured and erected.

Makers, by permission of that eminent authority **MR. GEORGE LIVESEY,** of his **CELEBRATED PATENT WASHER,** highly approved by all the Engineers of Works where adopted. Largely in demand.

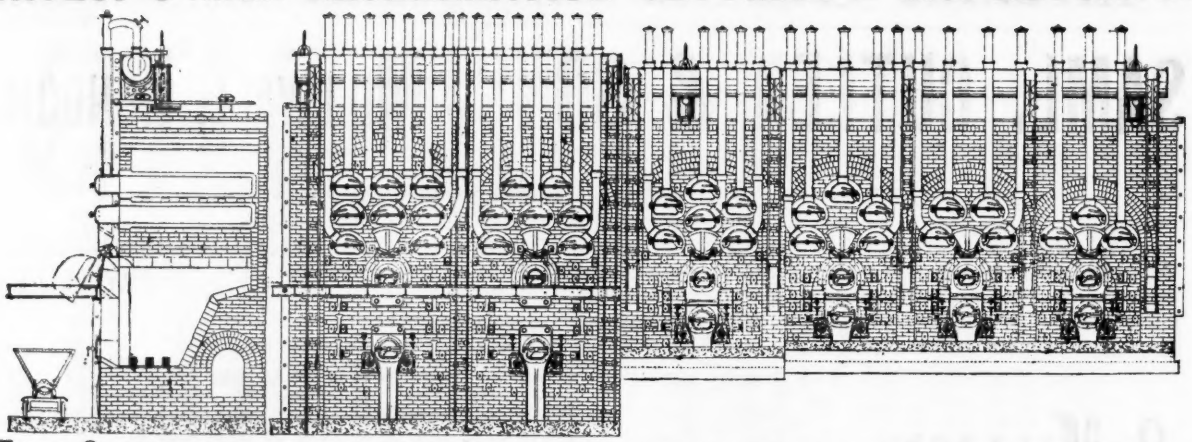
Special reference and attention are invited to our

WET AND DRY METERS,

which have acquired a high reputation for the **excellence** of Materials and Workmanship; their **durability** and **accuracy** of **Register** guaranteed. They are used by several of the **London Gas Companies,** and over **200 Provincial Gas Companies.**

Price Lists, Specifications, and Estimates provided for any work appertaining to Gas Lighting, from the Retort-House to the Drawing-Room.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stewart Street, Shawlands Glasgow; J. E. FISHER, Stourbridge, and from R. F. HISLOP (son of Patentee), Gas-Works, Paisley.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S PATENTS.

All Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

Descriptive Pamphlets and Terms from Agents as above.

Now Ready, Price One Guinea.

PRECEDENTS IN PRIVATE BILL LEGISLATION AFFECTING GAS & WATER UNDERTAKINGS.

1879-1890.

By E. H. STEVENSON and E. K. BURSTAL, MM.Inst.C.E.

The Work published in 1879 by the late Mr. Stevenson is still on sale.

LONDON: WALTER KING, 11, BOLT COURT, FLEET ST., E.C.

HYDRATED OXIDE OF IRON

FOR GAS PURIFICATION.

Two to three times as rich in Hydrate as Bog Ore.

STRONG ACTION ON SULPHURETTED HYDROGEN.

We have for sale Hydrate of Iron containing 77 per cent. of Ferric Oxide and 17 per cent. of Water. Directions given for mixing for Purifiers.

LESS THAN HALF THE PRICE OF BOG ORE.

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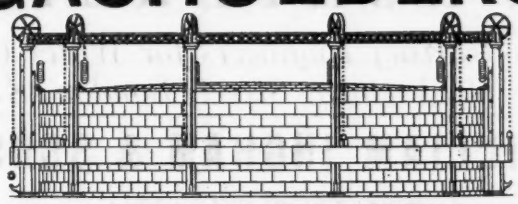
READ HOLLIDAY & SONS, LTD., HUDDERSFIELD.

HENRY BALFOUR & CO.,

LEVEN, FIFE.

MAKERS OF

GASHOLDERS



PRESSURE-REGULATORS FOR GASHOLDERS (See "JOURNAL" Dec. 20, 1892).

FOUR-WAY VALVES,

AND ALL CLASSES OF GAS APPARATUS.

HENRY PUPLETT, 47, Victoria Street, S.W.

OPENING ANNOUNCEMENT.

JAMES MILNE & SON, LTD.,

MILTON HOUSE WORKS, EDINBURGH,

Have pleasure in intimating the opening of a Branch Establishment at

48, WELLINGTON ST., LEEDS,

Consisting of SHOW-ROOMS, WAREHOUSE, and METER WORKSHOP.

Special attention given to Meter Repairs.

GAS FIXTURES, GAS AND WATER FITTINGS, SANITARY SPECIALTIES, &c.

GASHOLDERS

A Four-Lift Gasholder, nearly 200 feet high and 8 million cubic feet capacity, has been recently erected by us for The Gaslight and Coke Company, London.

PURIFYING MACHINES.

PURIFIERS. SULPHATE PLANT.

Weck's Centre-Valve.

C. & W. WALKER,

MIDLAND IRON-WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE;

10, Finsbury Square, London.

"FORTRESS DONNINGTON." "FORTRESS LONDON."—Telegraphic.

ALEX. C. HUMPHREYS, M.E.,
General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

A. G. GLASGOW. M.E..
Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
9, Victoria Street, London, S.W.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,
WORTLEY FIRE-CLAY WORKS
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES

AND

CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,

CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
C X O	"JACKSON"	BECK & Co.,
MARK.	CLAY CROSS.	130, ST. SUFFOLK ST., S.E.

GODDARD, MASSEY, & WARNER'S

IMPROVED

Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICE APPLY TO

GODDARD, MASSEY, & WARNER,

ENGINEERS,

NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (Four Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Fye Bridge.

And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

JONAS DRAKE & SON,

TELEGRAPHIC ADDRESSES
"DRAKESON, HALIFAX."
"ECLAIRAGE, LONDON"

TELEPHONE No. 43.
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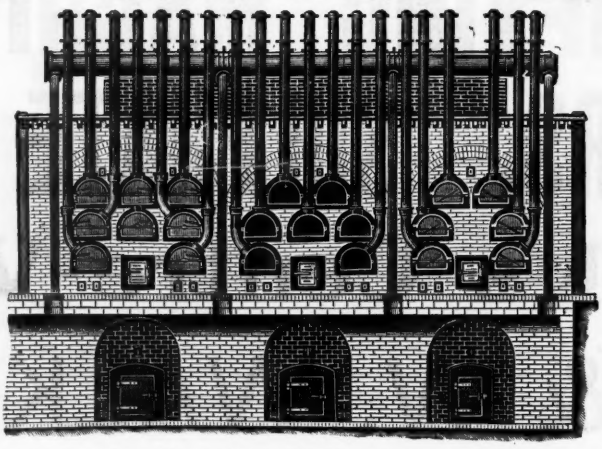

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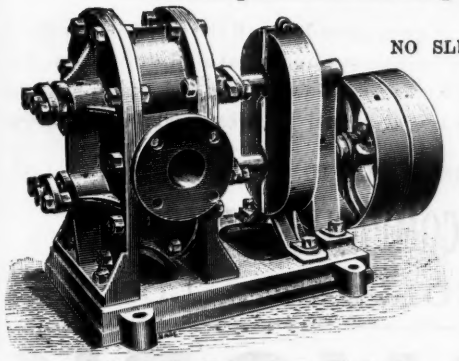

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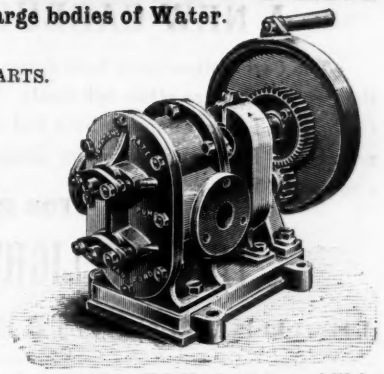

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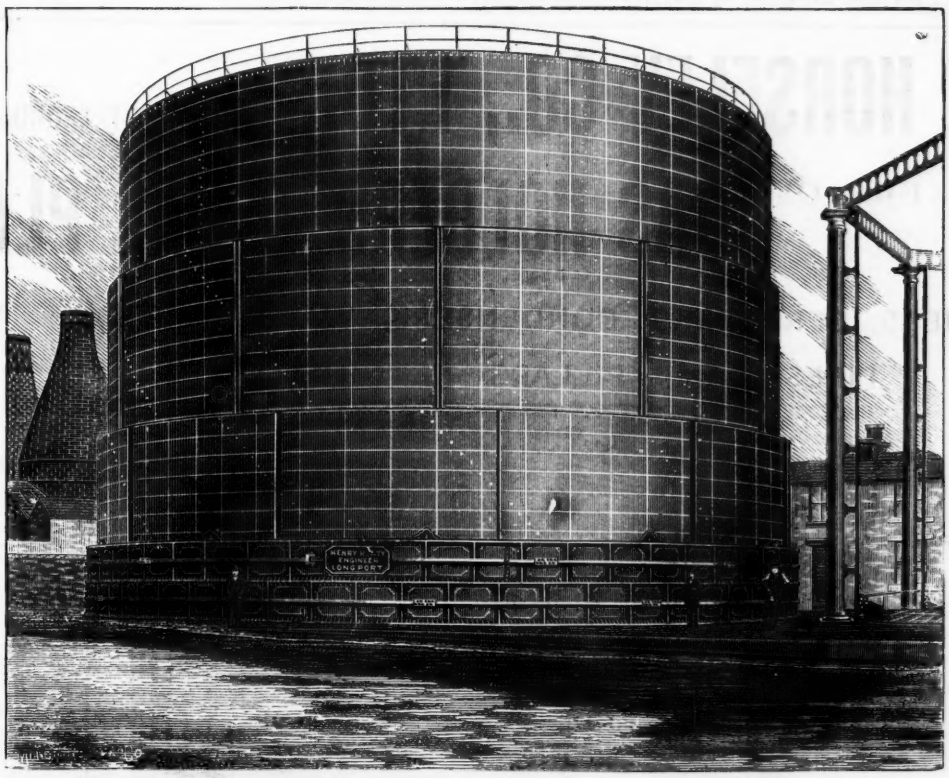

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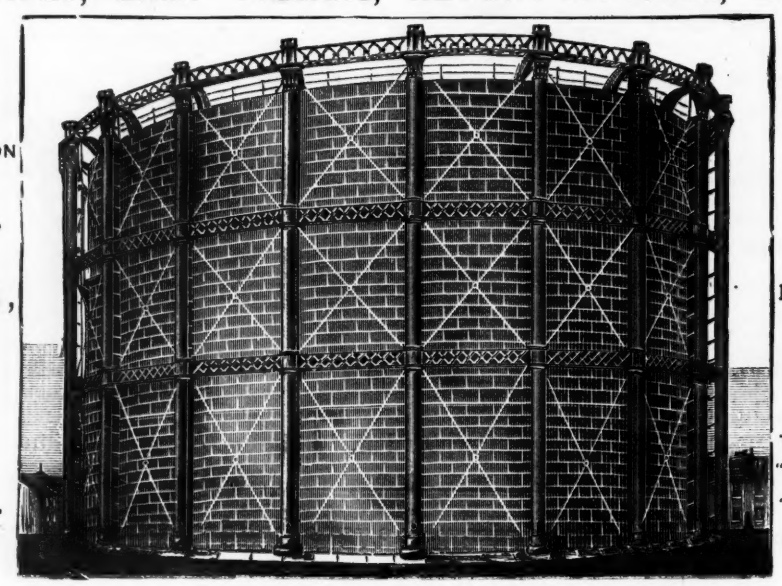

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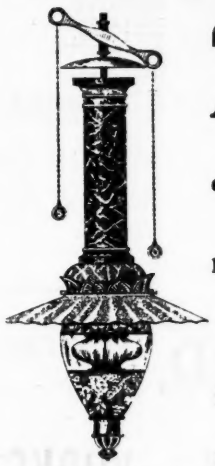

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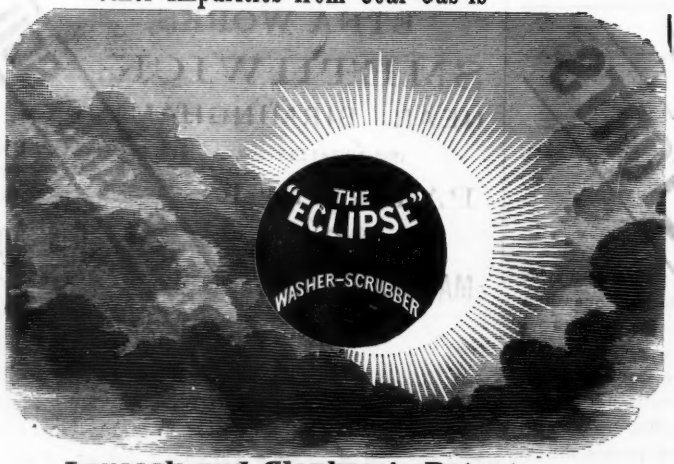

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